

**FINAL AQUATIC BIOTA STUDY REPORT**

Remedial Investigation and Remedial Action Selection

Term Contract Number A-47449

Matteo Iron and Metal West Deptford, New Jersey

Submitted to:



STATE OF NEW JERSEY
Department of Environmental Protection
401 East State Street,
Trenton, New Jersey

Submitted by:



The Louis Berger Group, Inc.
30 Vreeland Road
Florham Park, New Jersey 07932

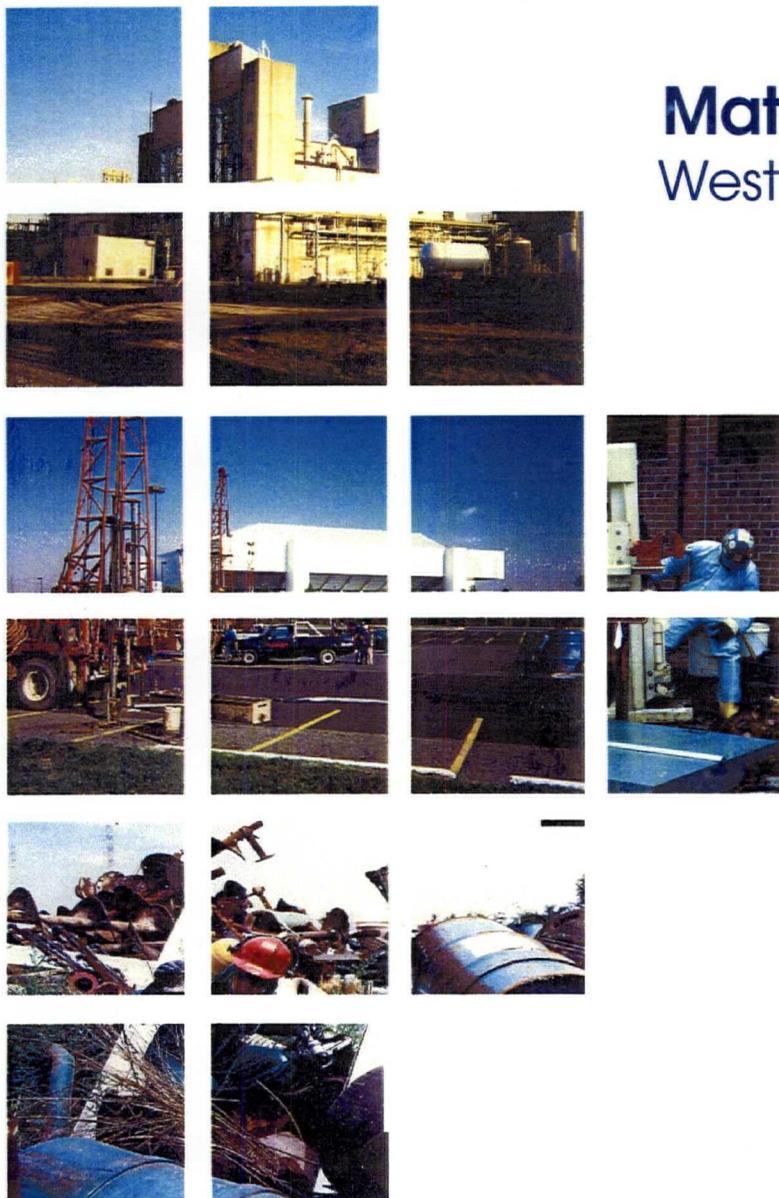


TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
1.0 INTRODUCTION	1-1
1.1 Study Area Description	1-1
1.2 Sampling Overview	1-1
2.0 WATER AND SEDIMENT QUALITY	2-1
2.1 Water Quality	2-1
2.2 Sediment Quality	2-3
3.0 SEDIMENT TOXICITY TESTING	3-1
3.1 Acute Testing.....	3-1
3.2 Growth Endpoint	3-4
4.0 FISH AND BENTHIC MACROINVERTEBRATE COMMUNITY ASSESSMENTS	4-1
4.1 Fish Community Assessment	4-1
4.2 Benthic Macroinvertebrate Community Assessment	4-5
5.0 TISSUE ANALYSIS.....	5-1
5.1 Fish Tissue.....	5-1
5.2 Benthic Macroinvertebrate Tissue.....	5-6
5.3 Upland Invertebrate Tissue.....	5-7
5.4 Wetland Plant Tissue.....	5-10
6.0 CONCLUSIONS.....	6-1
7.0 REFERENCES	7-1

List of Tables

Table 1. Aquatic Biota Study sample summary	1-4
Table 2. Lead concentration, total hardness and pH of water samples in the study area	2-2
Table 3. In-situ water quality data for the study area	2-2
Table 4. Sediment chemistry and contaminant concentrations	2-4
Table 5. Percent survival of <i>H. azteca</i> by replicate chamber and survival comparison with control sample	3-2
Table 6. Mean dry weight (mg) of <i>H. azteca</i> by replicate chamber and growth comparison with control sample.....	3-2
Table 7. Percent survival of <i>C. tentans</i> by replicate chamber and survival comparison with control sample	3-3
Table 8. Mean dry weight (mg) of <i>C. tentans</i> by replicate chamber and growth comparison with control sample.....	3-4
Table 9. Average time to 1 st emergence of <i>C. tentans</i> by sample station, using stations 8 and 9 for comparison.....	3-5
Table 10. Total emergence of <i>C. tentans</i> by station using station 8 for comparison	3-6
Table 11. Total emergence of <i>C. tentans</i> by station using station 9 for comparison	3-7
Table 12. Total survival of <i>C. tentans</i> by station using stations 8 and 9 for comparison.....	3-7
Table 13. Fish species abundance, richness, diversity, and trophic composition.....	4-2
Table 14. Comparisons of fish communities at stations sampled during both the present study and the 1977 study	4-4
Table 15. Benthic macroinvertebrate species abundance, richness, diversity, trophic composition, and pollution tolerance.....	4-6
Table 16. Concentrations of lead and PCB congeners in tissue of the fish <i>Fundulus diaphanus</i>	5-2
Table 17. Concentrations of lead and PCB congeners in tissue of the fish <i>Lepomis gibbosus</i>	5-2
Table 18. Concentrations of lead and PCB congeners in tissue of the fish <i>Fundulus heteroclitus</i> with lesions around the mouth or gills	5-3
Table 19. Concentrations of lead and PCB congeners in tissue of the Asian clam.....	5-7
Table 20. Concentrations of lead and PCB congeners in earthworm tissue.....	5-8
Table 21. Concentrations of lead and PCB congeners in tissue of the wetland plant spatterdock.....	5-10
Table 22. Concentrations of lead and PCB congeners in tissue of the wetland plant wild rice	5-10

List of Figures

Figure 1. Map of study area showing sampling stations	1-3
Figure 2. Water quality sampling in Woodbury Creek	2-1
Figure 3. Sediment collection in Hessian Run.....	2-3
Figure 4. Sediment Lead concentrations within study area	2-5
Figure 5. Sediment PCB concentrations within the study area	2-5
Figure 6. Finfish sampling in Hessian Run.....	4-1
Figure 7. <i>Fundulus diaphanus</i> length frequencies in the study area	4-5
Figure 8. <i>Fundulus heteroclitus</i> length frequencies in the study area.....	4-5
Figure 9. Sorting benthic samples in the field	4-6
Figure 10. Mean lead and PCB concentrations detected in the fish <i>Fundulus diaphanus</i>	5-3
Figure 11. Mean lead and PCB concentrations detected in the fish <i>Fundulus heteroclitus</i> and <i>Lepomis gibbosus</i> in the study area	5-4
Figure 12. Collecting Asian clams for tissue contaminant analysis	5-6
Figure 13. Mean lead and PCB concentrations detected in the Asian clam in the study area	5-7
Figure 14. Taking position of earthworm collection site with GPS	5-8
Figure 15. Mean lead concentrations detected in earthworm tissue in the study area	5-9
Figure 16. Mean PCB concentrations detected in earthworm tissue in the study area	5-9
Figure 17. Mean lead concentrations detected in wetland plants in the study area.....	5-12
Figure 18. Mean PCB concentrations detected in spatterdock in the study area	5-12
Figure 19. Mean PCB concentrations detected in wild rice in the study area.....	5-12
Figure 20. Sample Stations and Battery Casings.....	6-3

List of Appendices

Appendix A. Sediment toxicity testing - <i>Hyalella azteca</i>
Appendix B. Sediment toxicity testing - <i>Chironomus tentans</i>
Appendix C. Sediment toxicity testing - <i>Chironomus tentans</i> Emergence
Appendix D. Fish field data sheets
Appendix E. Statistical summary of fish catch in the study area
Appendix F. Benthic macroinvertebrate data sheets
Appendix G. Statistical summary of benthic macroinvertebrates collected in the study area
Appendix H. NJDEP diagnostic consultation report - <i>Fundulus heteroclitus</i>

EXECUTIVE SUMMARY

In order to assess the potential biological impacts of lead and PCB contamination in sediment and soil resulting from previous activities at the Matteo Iron and Metals site (Site), The Louis Berger Group, Inc. (Berger) conducted studies of the aquatic habitats and biotic communities within and adjacent to the Site in the summer of 2003. Specific studies included water and sediment quality investigations, sediment toxicity assessments, fish and benthic macroinvertebrate community assessments, and tissue contaminant sampling on earthworms, fish, shellfish, and wetland plants. The results of the biological tests were used to assess the bioavailability of contaminants to wildlife and humans and will support remedial action decisions.

Ten aquatic sampling stations were established in the study area, four of which were located adjacent to the Site (Site stations 3, 4, 5 & 6) while the remaining six stations intended as reference stations (reference stations 1, 2, 7, 8, 9 & 10), were located upstream and downstream of the Site in Hessian Run and Woodbury Creek. The dissolved oxygen levels and pH of surface water at Site stations in Hessian Run met the state criteria for FW2 waters. Concentrations of total recoverable lead in water at all Site stations were below the acute aquatic life protection standard, but three of the four Site stations (3, 5, and 6) exceeded the chronic aquatic life protection criteria. Sediment sampling revealed that concentrations of lead in sediments at all Site stations were greater than lead concentrations at all reference stations. Sediment lead concentrations exceeded the Lowest Effects Level of 31 ppm (LEL) at all Site stations, and lead concentrations at three of four Site stations (3, 4, and 6) also exceeded the Severe Effects Level of 250 ppm (SEL). While lead concentrations at Station 6 only slightly exceeded the SEL, lead concentrations recorded at stations 3 and 4, respectively, greatly exceeded the SEL. Based on results presented in the recent Remedial Investigation Report (RIR – Berger, 2004), the locations of Stations 3 and 4 coincide with those of the heaviest concentrations of lead bearing battery casings previously deposited along the Hessian Run shoreline. Concentrations of Aroclor 1254 and Aroclor 1260 detected at all four Site stations exceeded the LEL, but did not exceed the SEL. Concentrations of these two PCB congeners at Site station 4 were approximately ten times higher than concentrations detected at all other stations. Additionally, Site station 4 contained another PCB congener, Aroclor 1242, that was not detected at any other station in the study area.

Sediment toxicity at the ten aquatic sampling stations was investigated through acute exposure experiments using amphipods and larval midges as test organisms, with mortality and growth as measures of toxicity. In the amphipod testing, sediment from Site station 4 resulted in 100% mortality of test organisms, while Site Station 6 had significantly less test organism survival than the control (known environmental quality) sediment. Survival and growth at the other two Site stations (3 and 5) were not significantly different than survival in the control sediment. In the midge testing, sediment from Site station 4 again resulted in 100% mortality of test organisms, while the other three Site stations had significantly lower test organism survival than the control sediment. In both the amphipod and midge testing, several of the reference sites also had significantly lower survival than the control sediment.

Sediment toxicity was also investigated through a chronic exposure experiment lasting 65 days that used midges as test organisms, with the emergence of adult flies as the measure of toxicity. Significantly less emergence occurred at three of the four Site stations than the reference stations. Site station 3 also had a significantly greater number of days before first emergence than the reference stations.

The finfish community assessment compared species richness, diversity, and trophic composition at Site stations to reference stations. Only four species were caught at the Site stations, while twelve species were caught at the reference stations. Mean fish diversity at the four Site stations was considerably lower than at the six reference stations upstream and downstream in Hessian Run and in Woodbury Creek. The fish communities at the Site stations consisted almost entirely of omnivores, whereas fish communities at

the reference stations, while also primarily composed of omnivores, had a greater percentage of water-column feeders and top carnivores. In addition, three species not encountered in a 1977 fish survey of the study area (Hastings and Good, 1977) were caught during this study.

The benthic macroinvertebrate community assessment compared species richness, diversity, trophic composition, and pollution tolerance at Site stations to reference stations. Five taxa were collected at the Site stations, while nine taxa were collected at the reference stations. Mean taxa diversity of the Site stations was slightly lower than that of the reference stations. The benthic macroinvertebrate communities at Site stations and reference stations consisted almost entirely of deposit feeders, with few filter feeders or carnivores. Benthic taxa at the reference stations were primarily pollution-tolerant, but some moderately tolerant and sensitive taxa were present, while the Site stations consisted entirely of pollution-tolerant organisms.

Similar concentrations of lead were detected in fish and clam tissue from Site stations and Woodbury Creek reference stations. PCBs were detected in fish and clam tissue from Site stations and Woodbury Creek reference stations at similar concentrations. Concentrations of lead detected in the wetland plants spatterdock and wild rice at Site stations were considerably higher than those of the Woodbury Creek reference stations. Concentrations of two PCB congeners detected in these plant species at the Site stations were also considerably higher than at the reference stations. In earthworm tissue, lead concentrations at Site stations were over ten times greater than at the reference station. Concentrations of the two PCB congeners detected in earthworms at Site stations were eight times higher than at the reference station.

Twelve finfish species were caught in the study area. Aquatic invertebrate species observed in the study area include the nine benthic macroinvertebrates collected during the community assessment, as well as crayfish. The painted turtle, mud turtle, and snapping turtle were also observed in the study area. Dabbling waterfowl observed in the study area included ducks and Canada geese. Piscivorous birds observed in the study area included the Great Egret, Osprey, Common Tern, and Cormorant. This diversity of species represents a variety of pathways through which wildlife and humans can become exposed to lead and PCBs present at the Site.

1.0 INTRODUCTION

The Louis Berger Group, Inc. (Berger) has been contracted by the New Jersey Department of Environmental Protection (NJDEP) to perform site specific Remedial Investigations (RI) and Remedial Action Evaluations (RAS) at multiple sites throughout the state. As part of this contract, Berger conducted an Aquatic Biota Study (ABS) of the Matteo Iron and Metals site (Site) located in West Deptford, New Jersey (Figure 1).

In August and September 2003, Berger conducted studies of the aquatic habitats and biotic communities within and adjacent to the Site in order to assess the potential biological impacts of known on-site contamination. The contaminants of concern, as identified in the Remedial Investigation Report (May 2001), are lead (Pb) and PCBs. Based on a meeting with NJDEP representatives on March 14, 2001, and a Memorandum provided by the NJDEP dated November 9, 2001, these studies consisted of the following components:

- Sediment toxicity testing
- Water quality testing
- Assessment of resident benthic macroinvertebrate and fish communities, and
- Fish, plant, and benthic macroinvertebrate tissue analysis.

Results of the above biological tests may be used to support the remedial decisions beyond source removal and removal of severely contaminated sediments. If residual sediment contamination is found not to be bioavailable and risk to the aquatic biota is not indicated, further remediation of sediments may not be warranted; if bioavailability and risk are indicated, the decision for remedial action could be supported and determination of risk-based remedial goals will be facilitated by the results of the study.

1.1 Study Area Description

The Site is situated at the confluence of Woodbury Creek and Hessian Run, which experience diurnal tides. Tidal fluctuations range from approximately 5.4 feet at neap tides to approximately 6 feet at spring tides. Tidal currents are strong in the vicinity of Woodbury Creek and Hessian Run, however, there is no data reported on tidal current velocities. At low tide, Woodbury Creek is approximately 10 feet deep, whereas Hessian Run is reduced to a narrow stream less than a foot deep. Both Woodbury Creek and Hessian Run are classified as FW-2NT/SE2 waterways in which there may be a fresh water/salt water interface, however, salinity measurements taken during the Remedial Investigation averaged 0.01 parts per thousand, indicating a strictly freshwater habitat.

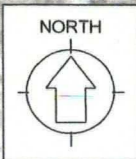
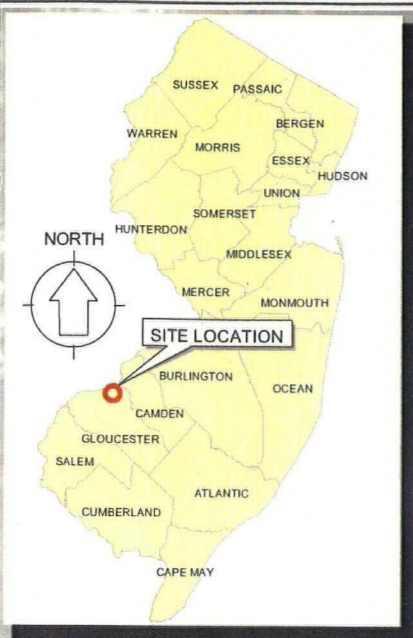
Figure 1 presents the location of sampling stations within the study area. Berger, in consultation with NJDEP, established seven sampling stations in Hessian Run and three stations in Woodbury Creek for sediment and water sampling, and biological community assessments. All ten stations are tidally influenced. Stations 3, 4, 5, and 6 (Site stations) in Hessian Run are adjacent to the Site upland areas where previous sampling revealed high soil concentrations of lead. In addition, three upland tissue sampling stations (4E, 4.5E, and 5E) were established on-Site, and one upland tissue sampling station was established off-Site (8E).

1.2 Sampling Overview

Table 1 presents a summary of parameters investigated at each station. Since several different types of samples were taken at each station for this study, a station was comprised of a transect from the high tide line to mid-channel. Specific sampling locations along transects for each sample type are described in

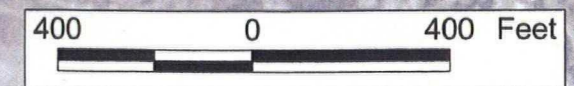
each respective section below. The geographic positions of each station were collected using a Trimble XRS Global Positioning System (GPS).

Sampling and investigation activities were performed in accordance with the *New Jersey Technical Requirements For Site Remediation*, (NJDEP, 1997), the *New Jersey Field Sampling Procedures Manual* (NJDEP, 1992); *Guidance for Sediment Quality Evaluations* (NJDEP, 1998), and where applicable, other relevant or appropriate United States Environmental Protection Agency (USEPA) regulations and guidance for conducting investigations at uncontrolled hazardous contamination sites.



LEGEND

- MATTEO IRON AND METAL SITE
- AQUATIC SAMPLING STATION
- UPLAND SAMPLING STATION



SOURCE: NJDEP DIGITAL ORTHOPHOTOS, 1995/1997.

Table 1. Aquatic Biota Study sampling summary.

Station	Fish and Benthic Community Assessment	Sediment Chemistry and Toxicity	Water Quality	Tissue Contaminant Analysis			
				Benthic Invertebrate	Fish	Plant	Earthworm
1*	X	X	X				
2*	X	X	X				
3	X	X	X	X	X		
4	X	X	X	X	X	X	
5	X	X	X	X	X	X	
6	X	X	X			X	
7*	X	X	X				
8*	X	X	X	X	X	X	
9*	X	X	X	X	X	X	
10*	X	X	X	X	X	X	
4E							X
4.5E							X
5E							X
8E*							X

* Intended as reference stations

2.0 WATER AND SEDIMENT QUALITY

2.1 Water Quality

2.1.1 Methods

Water quality samples and in-situ measurements were collected at all 10 stations on August 18 and 19 at high tide within the approximate quarter channel nearest the site. Surface water samples were collected using Kemmerer samplers, and were analyzed for lead, total hardness, and pH. In-situ parameters including temperature, salinity, conductivity, and dissolved oxygen were collected at each station using a YSI 610DM/6820 Environmental Monitoring System (EMS) data logger. Detailed field notes including time of day and tidal condition were recorded.

2.1.2 Results

Table 2 presents lead concentration, total hardness and pH of water samples in the study area. Sample IDs ending in "D" indicate filtered water samples in which the lead concentrations shown are for dissolved lead. Table 3 presents the in-situ water quality data for the study area.

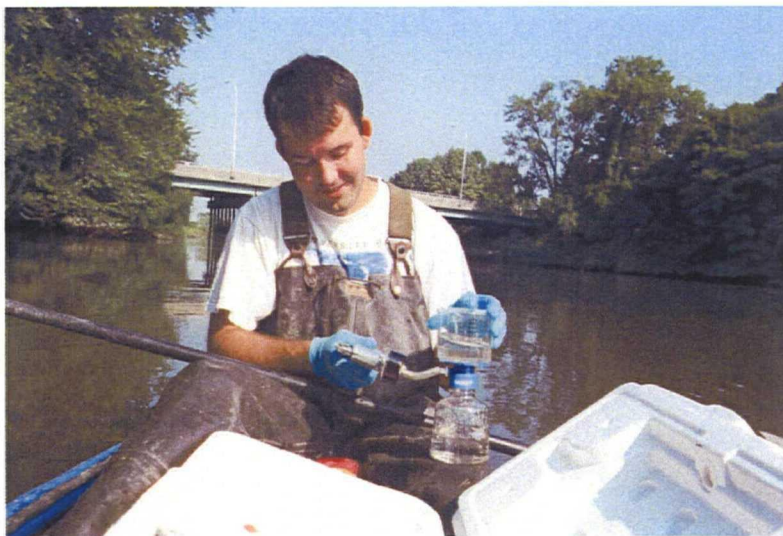


Figure 2. Water quality sampling in Woodbury Creek.

Table 2. Lead concentration, total hardness and pH of water samples in the study area.

Station	Sample ID	pH (Std. Units)	Total Hardness (ppm)	Lead (ppb)	Acute Lead Criterion* (ppb)	Chronic Lead Criterion* (ppb)
1	SW1	7.2	228	1.3 U	156.4	6.1
2	SW2	7.2	176	5.6	118.8	4.6
	SW2D	NA	NA	2.8U	NA	NA
3	SW3	7.3	160	8.9	107.3	4.2
	SW3D	NA	NA	2.8U	NA	NA
4	SW4	7.2	228	4.0	156.4	6.1
	SW4D	NA	NA	2.8U	NA	NA
5	SW5	7.3	100	5.9	64.6	2.5
	SW5D	NA	NA	2.8U	NA	NA
6	SW6	7.3	132	19.5	87.3	3.4
	SW6D	NA	NA	2.8U	NA	NA
7	SW7	7.2	136	3.4	90.1	3.5
	SW7D	NA	NA	2.8U	NA	NA
8	SW8	7.2	116	3.2	75.9	3.0
	SW8D	NA	NA	2.8U	NA	NA
9	SW9	7.3	108	2.8U	70.2	2.7
	SW9D	NA	NA	2.8U	NA	NA
9	SWDUP	7.3	112	2.8U	73.0	2.8
	SWDUPD	NA	NA	2.8U	NA	NA
10	SW10	7.2	76	5.0	47.8	1.9
	SW10D	NA	NA	2.8U	NA	NA

ppm = parts per million (milligrams/liter); ppb = parts per billion (micrograms/liter)

U = not detected above the sample quantitation limit (SQL)

NA = Not analyzed

*Corrected for total hardness

Bolded values indicate positive detections*Italicized values indicate exceedances of acute or chronic criteria***Table 3. In-situ water quality data for the study area.**

Station	Temperature (°C)	Salinity (ppt)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)
1	27.7	0.11	0.254	5.78
2	27.1	0.11	0.237	5.90
3	26.9	0.11	0.233	6.03
4	27.7	0.11	0.247	5.64
5	26.9	0.11	0.236	6.01
6	26.7	0.11	0.238	6.11
7	25.5	0.10	0.223	4.27
8	25.9	0.10	0.225	4.63
9	25.0	0.10	0.221	3.20
10	25.3	0.10	0.220	4.28

The surface water at all ten stations fell within the FW2 pH criteria of 6.5 to 8.5. Dissolved lead was not detected in any of the filtered samples, but lead (total recoverable) was detected in unfiltered samples from most stations. Lead concentrations were corrected for total hardness and acute and chronic aquatic life protection criteria were calculated for each sample. No station exceeded the acute life protection standard, but Stations 2, 3, 5, 6, 8, and 10 exceeded the chronic aquatic life protection criteria. Dissolved oxygen levels at all stations met the minimum NJDEP concentrations for FW2 waters of 4.0 mg/L, except Station 9 which is located off-Site.

2.2 Sediment Quality

2.2.1 Methods

Berger collected surface sediment samples (0 – 6" below ground surface) from the seven stations within the mudflats and various wetland habitats of Hessian Run and the three stations in Woodbury Creek for the range of lead and PCB concentrations that would remain outside of the remedial footprint. Sediment samples were taken from the mid-tide level at each station at low tide.

2.2.2 Results

Sediment chemistry and contaminant concentrations appear in Table 4.



Figure 3. Sediment collection in Hessian Run.

Table 4. Sediment chemistry and contaminant concentrations.

Sediment				Contaminants (ppm)							
Station	Sample ID	pH (Std. Units)	Total Organic Carbon (ppm)	Lead	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
1	SED1	6.4	101,200	217	0.05U	0.05U	0.05U	0.05U	0.05U	0.15J	0.15
2	SED2	6.6	55,800	175	0.04U	0.04U	0.04U	0.04U	0.04U	0.2	0.14
3	SED3	6.8	77,000	19,600	0.11U	0.11U	0.11U	0.11U	0.11U	0.39	0.23
4	SED4	6.6	151,700	2,200	1.40U	1.40U	1.40U	7J	1.40U	10	18
5	SED5	6.6	70,600	248	0.10U	0.10U	0.10U	0.10U	0.10U	1.2	0.44
6	SED6	6.4	155,800	349	0.083U	0.083U	0.083U	0.083U	0.083U	0.3	0.11
7	SED7	6.0	31,400	168	0.071U	0.071U	0.071U	0.071U	0.19J	0.66J	0.38
8	SED8	5.2	18,300	70	0.032U	0.032U	0.032U	0.032U	0.032U	0.032U	0.032U
9	SED9	6.9	25,200	96.1	0.052U	0.052U	0.052U	0.052U	0.077	0.16J	0.089J
9	SEDDUP	6.6	40,800	107	0.044U	0.044U	0.044U	0.044U	0.094J	0.18J	0.12J
10	SED10	6.2	29,700	88	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U
Lowest Effects Levels* (LEL), in ppm		NA	NA	31	0.007	NA	NA	NA	0.030	0.060	0.005
Severe Effects Levels* (SEL), in ppm		NA	NA	250	53	NA	NA	NA	150	34	24

U = not detected above the sample quantitation limit (SQL)

J = estimated concentration

Bolded values indicate positive detections* LEL and SEL values from NJDEP's *Guidance For Sediment Quality Evaluations* (1998)

Sediment lead concentrations at the reference stations (1, 2, 7, 8, 9, and 10) ranged from 70 to 217 ppm while concentrations at the Site stations (3, 4, 5 & 6) ranged from 248 to 19,600 ppm (see Figure 4). Aroclor 1242 was detected at Station 4, while Aroclor 1248 was detected at Stations 7 and 9. Concentrations of Aroclor 1254 and 1260 were detected at all stations except 8 and 10 (see Figure 5). At Station 4, concentrations of Aroclor 1242, 1254, and 1260 ranged from 7 to 18 ppm. Concentrations of Aroclor 1242, 1248, 1254, and 1260 detected at all other stations ranged from 0.077 to 1.2 ppm.

Sediment samples were compared to the Lowest Effect Level (LEL) and Severe Effects Level (SEL) Sediment Quality Criteria (SQC) (NJDEP, 1998). The LEL is the concentration at which adverse benthic impacts are found in approximately 10% of studies. NJDEP has determined that the LEL provides the most accurate screening criteria to evaluate sediment contaminants of concern. The LEL values are not cleanup standards, but screening guidelines for use in the Baseline Ecological Evaluation. An exceedance indicates a potential risk to the benthic community. The SEL indicates severe benthic impacts in 95% of studies. The SEL is provided for information purposes; NJDEP does not use the SEL as a screening criteria. These criteria were developed based on benthic community studies of sediment samples and do not directly address biomagnification (food chain toxicity) to birds and mammals. However, values found to be protective of the food chain are generally similar (within an order of magnitude) to LEL values. Lead concentrations exceeded the LEL at all ten stations, and lead concentrations at Stations 3, 4, and 6, also exceeded the SEL. While lead concentrations at Station 6 (349 ppm) only slightly exceeded the 250 ppm SEL, lead concentrations of 19,600 and 2,200 ppm recorded at Stations 3 and 4, respectively, greatly exceeded the 250 ppm SEL. Based on results presented in the recent Remedial Investigation Report (RIR – Berger, 2004), the locations of stations 3 and 4 coincide with those of the heaviest concentrations of lead bearing battery casings previously deposited along the Hessian Run shoreline (see Figure 20 at the end of this report). Concentrations of Aroclor 1248, Aroclor 1254, and Aroclor 1260 detected at stations in the study area all exceeded the LEL, but none exceeded the SEL.

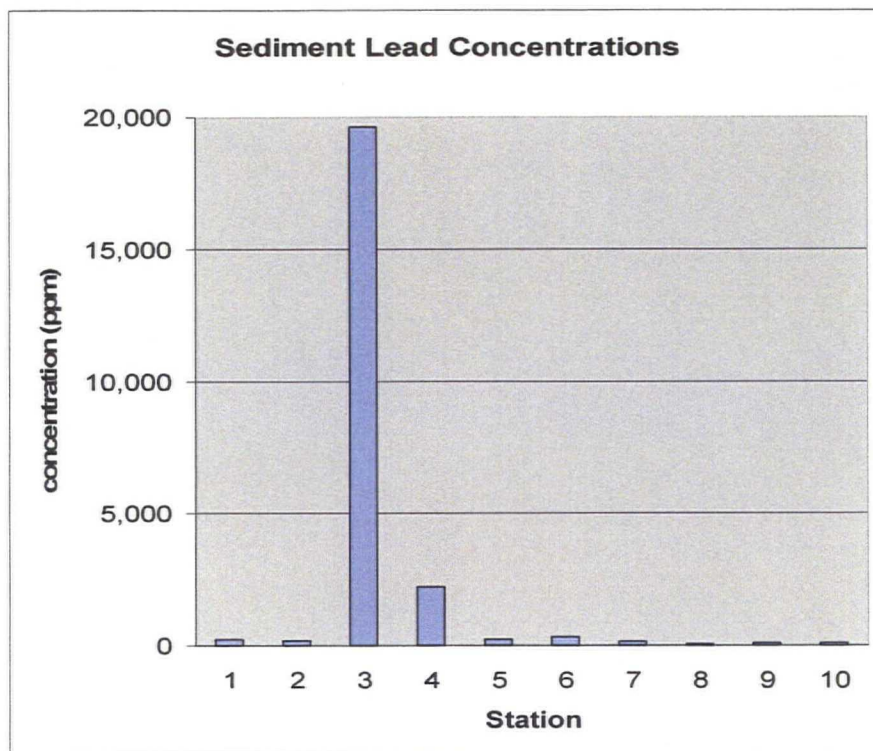


Figure 4. Sediment lead concentrations within study area.

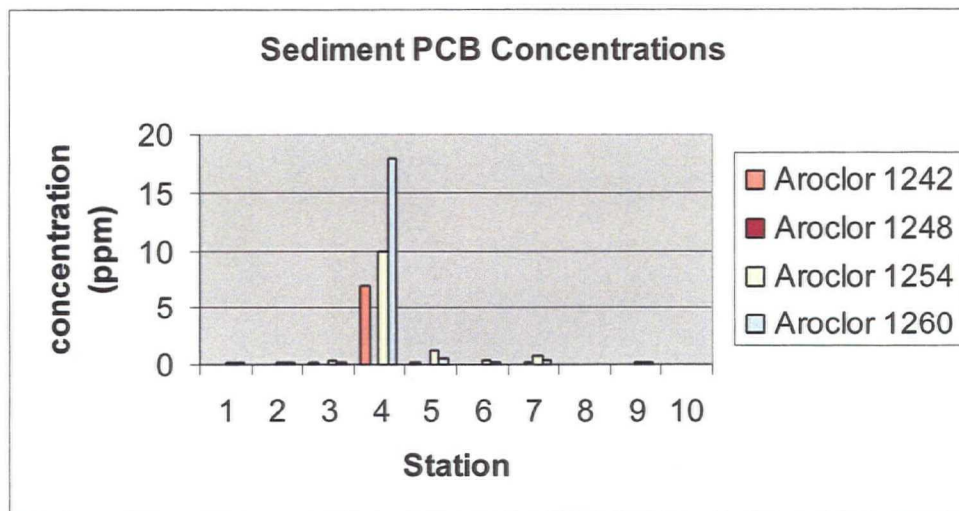


Figure 5. Sediment PCB concentrations within the study area.

3.0 SEDIMENT TOXICITY TESTING

Two gallons of surface sediment (0 – 6" below ground surface) were collected from all ten aquatic stations in the study area for sediment toxicity testing. These sediment samples were taken at the same times and locations as the sediment samples collected for the sediment quality investigation discussed above. Sediment toxicity was investigated by conducting survival and growth testing on two test organisms, the midge *Chironomus tentans*, and the amphipod *Hyaella azteca*, and by conducting growth endpoint (emergence) testing on *C. tentans*.

Data analysis was performed following procedures published by the USEPA (2000) using the Toxstat (1994) data analysis software. All data were transformed by arcsine squareroot and then tested for normality using the Shapiro-Wilk's test or the Chi-Square test and for homogeneity of variance using Bartlett's test, as appropriate. Analysis of variance (ANOVA) followed by Dunnett's *a posteriori* pairwise comparisons or Steel's Many-One Rank test, as appropriate, to evaluate differences between site samples and the control sample.

3.1 Acute Testing- Effects on Survival and Growth

3.1.1 *Hyaella azteca*

The sediment samples from the study area were evaluated for toxicity using a 28-day solid phase exposure with the amphipod *Hyaella azteca*. The sediment exposure series consisted of sediment samples from each of the ten stations in the study area and one of control sediment of known environmental quality (Spruce Run Reservoir). The endpoints used for determination of an impact in the amphipod exposures were mortality, measured as mean survival, and growth, measured as mean dry weight.

For each station, five replicate test chambers were filled with sediment over which test water was poured. The exposure period began by placing 10 randomly selected test organisms into each chamber. Observations were made and recorded for each chamber each day during the exposure period to assess organism health. Observations included the number of organisms dead, swimming, on the surface of the sediment, or on the surface of the water. At the end of the 28-day exposure, the sediment was carefully sorted and the surviving test organisms removed for live count verification and weight determination. The full details of this test, including raw data and statistical analysis, are provided in Appendix A.

The data were found to be normally distributed. Data were also tested for homogeneity of variances using Bartlett's test, and found to be homogeneous. It was therefore determined that parametric analyses were appropriate, and ANOVA followed by Dunnett's pairwise comparisons were used to determine differences between survival and growth of organisms in all samples and the control sample.

Effects on Survival

Results from the analysis, which compared survival in all samples with survival of organisms exposed to the control sample, are presented in Table 5. Samples from Station 4 caused 100% mortality and were eliminated from the analysis. Samples from stations 1, 2, 3, 5 and 8 did not produce mortality statistically different from the control exposure. Amphipods exposed to samples from stations 6, 7, 9 and 10 had significantly lower survival than those exposed to the control treatment, and were not included in the weight comparisons.

Table 5. Percent survival of *H. azteca* by replicate chamber and survival comparison with control sample.

	Station										
Replicate	Control	1	2	3	4*	5	6	7	8	9	10
A	100	100	100	90	0	100	100	70	100	60	90
B	90	90	100	80	0	100	70	40	100	80	60
C	100	90	100	90	0	80	60	70	90	100	80
D	100	100	90	70	0	100	60	60	80	70	60
E	100	100	80	90	0	80	60	40	90	70	50
Mean % Survival	98.0	96.0	94.0	84.0	0	92.0	70.0	56.0	92.0	76.0	68.0
Statistically Different from Control	-	No	No	No	Yes	No	Yes	Yes	No	Yes	Yes

* Sample 4 not included in ANOVA due to 100 % mortality.

Effects on Growth

Results from the analysis which compared mean dry weights for stations 1, 2, 3, 5 and 8 to the control sample are presented in Table 6. Of the five stations that did not exhibit excessive mortality compared to the control sample, stations 1, 2, 3 and 5 did not have mean dry weights significantly different from the control exposure. Only Station 8 was found to have significantly less average dry weight than the control exposure.

Table 6. Mean dry weight (mg) of *H. azteca* by replicate chamber and growth comparison with control sample.

	Station					
Replicate	Control	1	2	3	5	8
A	0.067	0.087	0.073	0.053	0.082	0.039
B	0.077	0.083	0.108	0.074	0.076	0.065
C	0.076	0.106	0.079	0.073	0.091	0.058
D	0.080	0.086	0.072	0.083	0.058	0.071
E	0.079	0.101	0.075	0.081	0.069	0.050
Mean Dry Weight (mg)	0.076	0.093	0.081	0.073	0.075	0.057
Statistically Different from Control	-	No	No	No	No	Yes

3.1.2 *Chironomus tentans*

The sediment samples from the site were also evaluated for toxicity using a 20-day solid phase exposure with the midge *Chironomus tentans*. Like the amphipod tests, the sediment exposure series consisted of sediment samples from each of the ten stations in the study area and one of control sediment of known environmental quality (Spruce Run Reservoir). The endpoints used for determination of an impact in the midge exposures were mortality, measured as mean survival, and growth, measured as mean dry weight.

The test chambers were prepared the same as for the amphipod tests, and the number of replicate samples was the same, but for the midge, 12 individuals were placed into each chamber. Observations were made and recorded for each chamber each day during the exposure period to assess organism health. Observations included the number of organisms dead, swimming, on the surface of the sediment, or on the surface of the water. At the end of the 20-day exposure, the sediment was carefully sorted and the surviving test organisms removed for live count verification and weight determination. The full details of this test, including raw data and statistical analysis, appear in Appendix B.

The data were found to be normally distributed. Data were also tested for homogeneity of variances using Bartlett's test, and found to be homogeneous. It was therefore determined that parametric analyses were appropriate, and ANOVA followed by Dunnett's pairwise comparisons were used to determine differences between survival and growth of organisms in all samples and the control sample.

Effects on Survival

Results from the analysis which compared survival in all samples with survival of organisms exposed to the control sample are presented in Table 7. Once again, samples from Station 4 caused 100% mortality and were eliminated from analysis. Samples from stations 8 and 9 did not produce mortality statistically different from the control exposure. Chironomids exposed to samples from stations 1, 2, 3, 5, 6, 7 and 10 had significantly less survival than those exposed to the control treatment, and were not included in the weight comparisons.

It should be noted that the recommended minimum control survival for chironomids in a 20-day exposure is 70% and this data set produced control survival of 66.7%. This decreased survival in the control may be an artifact of the handling procedures of the newly hatched test organisms during their placement into the test chambers. Since the <24 hour old midge larvae need to be sorted under a dissecting microscope to facilitate their removal from the egg case debris, they are not placed in an interim holding vessel prior to introduction to the test chambers. They are placed directly into the test exposure chambers and this limits the amount of observation time to replace those individuals that may have been adversely affected by handling. As the survival rates for the site samples are markedly lower than the controls, this slight depression in the control survival does not appear to have any adverse impact on the data analysis.

Table 7. Percent survival of *C. tentans* by replicate chamber and survival comparison with control sample.

Replicate	Station										
	Control	1	2	3	4*	5	6	7	8	9	10
A	58.3	50	33.3	0	0	16.7	33.3	16.7	50	8.3	16.7
B	66.7	50	8.3	16.7	0	25	58.3	8.3	75	41.7	16.7
C	58.3	33.3	16.7	0	0	50	0	8.3	58.3	58.3	41.7
D	75	0	66.7	0	0	16.7	50	16.7	100	66.7	8.3
E	75	0	0	8.3	0	16.7	25	33.3	66.7	33.3	33.3
Mean % Survival	66.7	26.7	25	5	0	25	33.3	16.7	70	41.7	23.3
Statistically Different from Control	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes

* Sample 4 not included in ANOVA due to 100 % mortality

Effects on Growth

Results from the analysis which compared mean dry weights for stations 8 and 9 to the control sample are presented in Table 8. Neither of these stations had mean dry weights significantly different from the control exposure.

Table 8. Mean dry weight (mg) of *C. tentans* by replicate chamber and growth comparison with control sample.

Replicate	Station		
	Control	8	9
A	0.789	0.583	1.98
B	0.768	0.550	0.516
C	0.670	0.624	0.579
D	0.450	0.515	0.650
E	0.48	0.695	0.998
Mean Dry Weight (mg)	0.645	0.593	0.945
Statistically Different from Control	-	No	No

3.2 Growth Endpoint - 65-day Exposure

The sediment samples from stations in the study area were also evaluated for toxicity using a 65-day solid phase exposure with the midge *Chironomus tentans*. The endpoints used for determination of an impact in the midge exposures were number of flies which had emerged from the sample sediment.

Like the other tests, the sediment exposure series consisted of sediment samples from each of the ten stations in the project area and one of control sediment from Spruce Run Reservoir. The test chambers were prepared the same as for the 20-day midge tests and the number of replicate samples and test organisms was the same. Observations including the number of organisms dead, swimming, on the surface of the sediment, or on the surface of the water were made and recorded daily to assess organism health. The full details of this test, including raw data and statistical analysis, are provided in Appendix C.

Beginning on Day 20, all test chambers were tightly covered with fine mesh nylon window screen and rubber bands. These covers retained emergent adults in their respective chambers so they could be recorded twice per day. Those individuals that achieved complete emergence were recorded as adult flies to be used in the statistical analysis of this endpoint. Incomplete emergence, those individuals that successfully began to emerge from the pupae, but then became caught, or expired in the process, were recorded as such but not included in the statistical analysis. There were only two individuals that were recorded as incomplete emergents.

On Day 44 of the exposure, the controls reached a total emergence of 53.3% (32 of original 60 test individuals). As this was the final endpoint being assessed, the control treatment could be ended when it achieved >50% emergence of original test organisms. At this time, each test sample was evaluated individually on a daily basis to determine when it should end. Once a site sample had not recorded a new

emergent adult for seven consecutive days after the control treatment ended, that set of five replicate chambers was carefully sorted and all remaining surviving test organisms were recorded.

Effects on First Emergence

The number of days each replicate took to produce the first adult was recorded as a percentage of the total time of the test exposure, 65 days. The data were found to be normally distributed. Data were tested for homogeneity of variances using Bartlett's test, and found to be homogeneous. It was therefore determined that parametric analyses were appropriate, and ANOVA followed by Dunnett's pairwise comparisons were used to determine differences between survival of organisms in all samples and the control sample.

Results from the analysis, which compared the time to first emergence in all samples with that of Stations 8 and 9, the two reference stations, are presented in Table 9. The control values are included for comparative purposes.

Of the sample stations in the study area, only Station 3 was found to have a significantly greater number of days to first emergence. All remaining stations: 4, 5, 6, 7 and 10 did not produce values statistically different from either of the reference stations. Stations 1 and 2 are not included in this analysis as they were originally designed to be used as reference stations, but unacceptable survival precluded their use as references.

Table 9. Average time to 1st emergence of *C. tentans* by sample station, using Stations 8 and 9 for comparison.

Station	Average Days to 1 st Emergence	% of 65 Day Exposure	Significant vs. Station 8 ²	Significant vs. Station 9 ²
Control ¹	29.2	44.9	-	-
8	31.4	48.3	-	N/A
9	30.8	47.4	N/A	-
3	51.2	78.8	Yes	Yes
4	41.6	64.0	No	No
5	40.8	62.8	No	No
6	36.6	56.3	No	No
7	33.6	51.7	No	No
10	31.2	51.1	No	No

1 - Control included for comparison only

2 - Reference stations not compared to each other

Effects on Total Emergence-Comparison with Station 8

Results from the analysis which compared the total emergence in all samples with that of Station 8 are presented in Table 10. Emergence is evaluated at seven day intervals beginning with Day 44, when the control treatment reached >50% emergence. The control value is included for comparative purposes.

Station 8 ended on day 61, with a total emergence of 66.8%. It should be noted here that at Day 44, when the control treatment surpassed the 50% emergence level, Station 8 had produced 48.4% emergent adults. However, the criterion for the ending any sample treatment was no emergent individuals for seven consecutive days, so Station 8 continued until Day 61. Of the stations in the project area compared with reference station 8, Stations 6 and 7 at no time showed a significant difference in total emergence on any

of the days used for evaluation (44, 51, 58 and 65). Of the four remaining stations; 3, 4, 5 and 10, all had significantly less emergence at day 44 compared to Station 8. At 51 days, Station 3 had ended, Stations 4 and 5 were still statistically different compared to Station 8, and Station 10 had produced sufficient numbers of adults to not be significantly different at day 51. At 58 days, Station 5 had ended, and Stations 4 and 10 were different from the reference. At the end of the test, Day 65, Station 4 had ended and Station 10 was again not statistically different from station 8. Stations 3, 4 and 5 have been highlighted in the table below to show that at all points during the exposure period these samples were producing significantly different responses compared to that of the reference (Station 8). The last sample from Station 10, appears to have suffered some deleterious response, however, the statistical analysis at Day 65 did not find the final emergence of 39.4% to be different from the reference sample.

Table 10. Total emergence of *C. tentans* by station using Station 8 for comparison.

Station	Percent Emergence @ 44 days	Significant vs. sta. 8 @ 44 days	Percent Emergence @ 51 days	Significant vs. sta. 8 @ 51 days	Percent Emergence @ 58 days	Significant vs. sta. 8 @ 58 days	Percent Emergence @ 65 days	Significant vs. sta. 8 @ 65 days
Control	53.4	-	-	-	-	-	-	-
8	48.4	-	61.6	-	66.8	-	66.8	-
3	3.2	Yes	Ended	-	-	-	-	-
4	16.4	Yes	19.8	Yes	19.8	Yes	Ended	-
5	16.6	Yes	16.6	Yes	Ended	-	-	-
6	35	No	48.2	No	70	No	76.8	No
7	28.2	No	41.6	No	46.6	No	46.6	No
10	24.8	Yes	34.8	No	34.8	Yes	39.8	No

Effects on Total Emergence-Comparison with Station 9

Results from the analysis which compared the total emergence in all samples with that of Station 9 are presented in Table 11. Emergence is evaluated at seven-day intervals beginning with Day 44, when the control treatment reached >50% emergence. The control value is included for comparative purposes.

Station 9 ended on Day 65, with a total emergence of 71.6%. It should be noted here that at Day 44, when the control treatment surpassed the 50% emergence level, Station 9 had produced 45.2% emergent adults. However, the criterion for the ending any sample treatment was no emergent individuals for seven consecutive days, so Station 9 continued until Day 65. Of the stations in the study area compared with reference Station 9, Stations 6 and 7 at no time showed a significant difference in total emergence on any of the days used for evaluation (44, 51, 58 and 65). Of the four remaining stations; 3, 4, and 5 had significantly less emergence at Day 44 compared to station 9. Station 10 was not significantly different from reference Station 9. At 51 days, Station 3 had ended, Stations 4 and 5 were still statistically different compared to Station 9, and Stations 6, 7 and 10 were not significantly different from Station 9. At 58 days, Station 5 had ended, and Stations 4 and 10 were significantly different from Station 9. At the end of the test, Day 65, Station 4 had ended, Stations 6 and 7 ended with no difference compared to Station 9 and Station 10 remained statistically different from Station 9. Stations 3, 4 and 5 have been highlighted in the table below to show that at all points during the exposure period these samples were producing significantly different responses compared to that of Station 9.

Table 11. Total emergence of *C. tentans* by sample location using Station 9 for comparison.

Station	Percent Emergence @ 44 days	Significant vs. sta. 9 @ 44 days	Percent Emergence @ 51 days	Significant vs. sta. 9 @ 51 days	Percent Emergence @ 58 days	Significant vs. sta. 9 @ 58 days	Percent Emergence @ 65 days	Significant vs. sta. 9 @ 65 days
Control	53.4	-	-	-	-	-	-	-
9	45.2	-	58.4	-	66.8	-	71.6	-
3	3.2	Yes	Ended	-	-	-	-	-
4	16.4	Yes	19.8	Yes	19.8	Yes	Ended	-
5	16.6	Yes	16.6	Yes	Ended	-	-	-
6	35	No	48.2	No	70	No	76.8	No
7	28.2	No	41.6	No	46.6	No	46.6	No
10	24.8	No	34.8	No	34.8	Yes	39.8	Yes

Effects on Total Survival

Results from the analysis which compared the total survival in all samples with that of Stations 8 and 9 are presented in Table 12. The control values are included for comparative purposes. The remaining stations; 1, 2 and 10 were considered as alternate reference stations but unacceptable survival precluded their use as references. The recommended minimum survival for the emergence portion of this test is 65% at the completion of testing. The control treatment as well as Stations 8 and 9 exceeded this level of surviving test organisms.

Of the sample stations in the study area, Station 3 was found to have a significantly lower survival than Stations 8 and 9. Stations 4 and 7 were found to have statistically different survival rates when compared to Station 9.

Table 12. Total survival of *C. tentans* by sample location using Stations 8 and 9 for comparison.

Station	Percent Total Survival	Significant vs. Control	Significant vs. Station 8	Significant vs. Station 9
Control	88.3	-	-	-
1	25.0	Yes	-	-
2	40.0	Yes	-	-
3	50.0	-	Yes	Yes
4	21.7	-	No	Yes
5	81.7	-	No	No
6	81.7	-	No	No
7	46.7	-	No	Yes
8	68.3	No	-	NA
9	80.0	No	NA	-
10	55.0	Yes	No	No

1 – Control included for comparison only

NA – Stations 8 and 9 were not compared to each other

4.0 FISH AND BENTHIC MACROINVERTEBRATE COMMUNITY ASSESSMENTS

4.1 Fish Community Assessment

4.1.1 Methods

Berger conducted an assessment of the resident fish communities to evaluate the ecological integrity of the aquatic system adjacent to the Site. Berger collected fish samples from each of the seven stations within Hessian Run and three stations within Woodbury Creek (Figure 1). Berger utilized fish collected during this effort to supply tissue samples for the analyses described in Section 5.1. Fish samples were collected using a 30-foot beach seine (0.25-inch mesh) (Figure 6), except at Stations 1, 2, and 3 in Hessian Run where a 10-foot seine (0.25 inch mesh) was used because of the narrow channel width. Three replicate hauls were made within two hours of low tide at each station in the opposite direction of the prevailing tidal current. Each haul attempted to cover 20 meters of the substrate, but in many cases, submerged obstructions such as logs and stumps limited hauls to shorter distances. Fish were identified in the field and counted, and 25 individuals of each species were measured per replicate sample, if available.

4.1.2 Results

Table 13 presents the fish species richness, diversity, and trophic composition at each of the 10 stations sampled during the study. Results of the fish survey were compared with historical studies conducted within the project vicinity (*e.g.*, Hastings and Good, 1977). Raw fish data and statistical summary are provided in Appendices D and E.



Figure 6. Finfish sampling at Station 5 in Hessian Run, looking west.

Table 13. Fish species abundance, richness, diversity, and trophic composition.

Species Name	Common Name	Abundance										Totals	
		Station										Stations 3, 4, 5 and 6	Reference Stations
		1	2	3	4	5	6	7	8	9	10		
<i>Fundulus diaphanus</i>	Banded Killifish	14	3	15	306	67	50	22	370	384	61	438	854
<i>Fundulus heteroclitus</i>	Mummichog	8	6	12	708	224	26	16	2	15	4	970	51
<i>Etheostoma olmstedii</i>	Tessellated darter	1						3	10	1	5		20
<i>Hybognathus regius</i>	Eastern Silvery Minnow	1	1						2	38	42		84
<i>Alosa pseudoharengus</i>	Alewife				2			3	39	4	13	2	59
<i>Lepomis gibbosus</i>	Pumpkinseed		1		7	1		1	2	5	1	8	10
<i>Anguilla rostrata</i>	American Eel								3	2			5
<i>Anchoa spp.</i>	Anchovy								2	1			3
<i>Menidia menidia</i>	Silversides										1		1
<i>Morone americana</i>	White Perch		1					1	44	19	14		79
<i>Morone saxatilis</i>	Striped Bass								4		2		6
<i>Trinectes maculatus</i>	Hogchoker							1	3				4
Total		24	12	27	1023	292	76	47	481	469	143	1418	1176
Species Richness													
(total number of species caught)		4	5	2	4	3	2	7	11	9	9	4	12
Shannon-Weaver Diversity Index													
(mean of station replicates)		0.334	0.275	0.298	0.288	0.260	0.279	0.510	0.390	0.306	0.586	0.287	0.473
Trophic Composition													
% omnivores		96	83	100	99	100	100	81	78	93	76	99	84
% bottom invertebrate feeders		4	0	0	0	0	0	9	3	0	3	0	2
% water column feeders		0	8	0	1	0	0	9	9	2	10	1	6
% top carnivores		0	8	0	0	0	0	2	11	4	11	0	8

Species Richness and Diversity

Overall, twelve species of fish were caught in the study area. Of these, four species are freshwater (*Fundulus diaphanus*, *Etheostoma olmstedii*, *Hybognathus regius*, and *Lepomis gibbosus*), six are estuarine and marine (*Fundulus heteroclitus*, *Anchoa spp.*, *Menidia menidia*, *Morone americana*, *Morone saxatilis*, and *Trinectes maculatus*), and two are diadromous (*Alosa pseudoharengus* and *Anguilla rostrata*). Only four species were caught at stations adjacent to the Site (Stations 3, 4, 5, and 6), while twelve species were caught at the reference stations.

For stations adjacent to the Site (Stations 3, 4, 5, and 6), diversity was particularly low, with the catch consisting almost entirely of *F. diaphanus* and *F. heteroclitus*, with only a few individuals of *A. pseudoharengus* and *L. gibbosus* caught. Mean fish diversity at these four stations, as measured by the Shannon-Weaver Diversity Index, was 0.287, while at the reference stations upstream and downstream in Hessian Run and in Woodbury Creek, the fish diversity index was 0.473. Fish species caught in Woodbury Creek included *Anguilla rostrata*, *Anchoa spp.*, *Menidia menidia*, and *Morone saxatilis*, in addition to the eight species caught in Hessian Run. Fish diversity was relatively low in Hessian Run, compared to Woodbury Creek. *Fundulus diaphanus* and *Fundulus heteroclitus* comprised over 98% (1,477 of 1,501) of fish caught in Hessian Run. Very low numbers of six additional species (24

individuals) were caught in Hessian Run, including *Etheostoma olmstedii*, *Hybognathus regius*, *Alosa pseudoharengus*, *Lepomis gibbosus*, *Morone americana*, and *Trinectes maculatus*.

Trophic Composition

The trophic composition of the fish communities at stations in Hessian Run and Woodbury Creek is depicted in Table 13. Trophic compositions are based on the percentage of individuals which are either omnivores (*Fundulus diaphanus*, *Fundulus heteroclitus*, *Hybognathus regius*, and *Menidia menidia*), bottom invertebrate feeders (*Etheostoma olmstedii* and *Trinectes maculatus*), water column feeders (*Alosa pseudoharengus*, *Lepomis gibbosus* and *Anchoa* spp.), or top carnivores (*Anguilla rostrata*, *Morone americana*, and *Morone saxatilis*). Because of the dominance of *F. diaphanus* and *F. heteroclitus* in the fish communities of the study area, omnivores dominate these communities. The fish communities at Hessian Run stations consisted largely of omnivores (86% to 100%), with few fish in the other trophic levels, particularly Stations 3, 4, 5, and 6 (on-Site) which consisted almost entirely of omnivores (99% to 100%). Omnivores were also dominant at the Woodbury Creek stations (76% to 93% of individuals), but to a lesser degree than in Hessian Run. The greatest proportion of top carnivores in the community was found at stations in Woodbury Creek.

Comparison with Previous Studies

Station 2 and 7 in Hessian Run and Station 9 in Woodbury Creek were also sampled by Hastings and Good (1977) during August, allowing direct comparisons of species richness (Table 14). Unfortunately, no sampling was performed adjacent to the Site in the 1977 study, so no comparisons with the Site across time is possible. In Hessian Run, the same number of species was caught in both studies (8). However, the 1977 study encountered three species, *Anguilla rostrata*, *Notropis hudsonius*, and *Pinephales notalus*, which were not found in 2003. Three species, *Etheostoma olmstedii*, *Alosa pseudoharengus*, and *Trinectes maculatus*, were caught in 2003 but were not encountered in 1977. *A. pseudoharengus* was caught in 2003 in Hessian Run during other sampling months in 1977, but *E. olmstedii* and *T. maculatus* were not caught in either Hessian Run or Woodbury Creek in 1977. Since the 1977 study spanned several months, it is unlikely that these two species occurred there at that time. The present study did not catch *A. rostrata* in Hessian Run during the fish community assessment, but several individuals were subsequently caught within Hessian Run during invertebrate tissue collection efforts.

At Station 9 in Woodbury Creek, the same number of species (9) was caught in both studies, however, the 1977 study reported four species not found in 2003: *Pinephales notalus*, *Pomoxis nigromaculatus*, *Notemigonus crysoleucas*, and *Alosa aestivalis*. Four species, *Etheostoma olmstedii*, *Lepomis gibbosus*, *Anguilla rostrata*, and *Anchoa* spp. were found in 2003 but not in August 1977, however, *L. gibbosus* and *A. rostrata* were caught in Woodbury Creek during other sampling months in 1977. *E. olmstedii* and *Anchoa* spp. were not caught in either Hessian Run or Woodbury Creek in 1977, and since that study spanned several months, it is unlikely that these two species occurred there at that time.

Looking beyond Station 9, several other species not observed in Woodbury Creek in August 1977 were caught in 2003, including *Menidia menidia* and *Morone saxatilis*. Again, the 1977 study spanned several months, so it is unlikely that these species would have been missed had they been present.

Table 14. Comparisons of fish communities at stations sampled during both the present study and the 1977 study.

Species	Hessian Run (Stations 2 and 7)		Woodbury Creek (Station 9)	
	1977	2003	1977	2003
<i>Fundulus diaphanus</i>	x	x	x	x
<i>Fundulus heteroclitus</i>	x	x	x	x
<i>Etheostoma olmstedii</i>		x		x
<i>Hybognathus regius</i>	x*	x	x	x
<i>Alosa pseudoharengus</i>		x	x	x
<i>Lepomis gibbosus</i>	x	x		x
<i>Anguilla rostrata</i>	x			x
<i>Anchoa</i> spp.				x
<i>Menidia menidia</i>				
<i>Morone americana</i>	x	x	x	x
<i>Morone saxatilis</i>				
<i>Trinectes maculatus</i>		x		
<i>Notropis hudsonius</i>	x			
<i>Pinephales notalus</i>	x		x	
<i>Pomoxis nigromaculatus</i>			x	
<i>Notemigonus crysoleucas</i>			x	
<i>Alosa aestivalis</i>			x	
Total species	8	8	9	9

x = present

*Identified as *Hybognathus nuchalis* by Hastings and Good

Occurrence and Length Frequency Distributions of *Fundulus* spp.

Fundulus diaphanus and *Fundulus heteroclitus* constituted approximately 89% of the total number of fish caught during the study. These two species were nearly equally abundant overall, but *F. heteroclitus* in Hessian Run outnumbered *F. diaphanus* by 2 to 1 (1,000 to 477); whereas in Woodbury Creek, *F. diaphanus* outnumbered *F. heteroclitus* by nearly 40 to 1 (815 to 21). *F. heteroclitus* is an extremely hardy species and is able to tolerate the more stressful environmental conditions encountered in Hessian Run at low tide when the water may be less than a foot deep. *F. diaphanus* was relatively more abundant in Woodbury Creek near low tide, where environmental conditions are much less variable than in Hessian Run.

The length frequency distributions of *F. diaphanus* and *F. heteroclitus* in the study area appear in Figures 7 and 8. Lengths from the three replicates at each station were pooled. Members of the 2002 and 2003 year classes of both species were found in Hessian Run and Woodbury Creek. These year classes for *F. diaphanus* consist of distinct peaks at 35 mm and 68 mm, while for *F. heteroclitus*, the peaks are less distinct but appear at 38 mm and 59 mm, with a possible third year class at 75 mm.

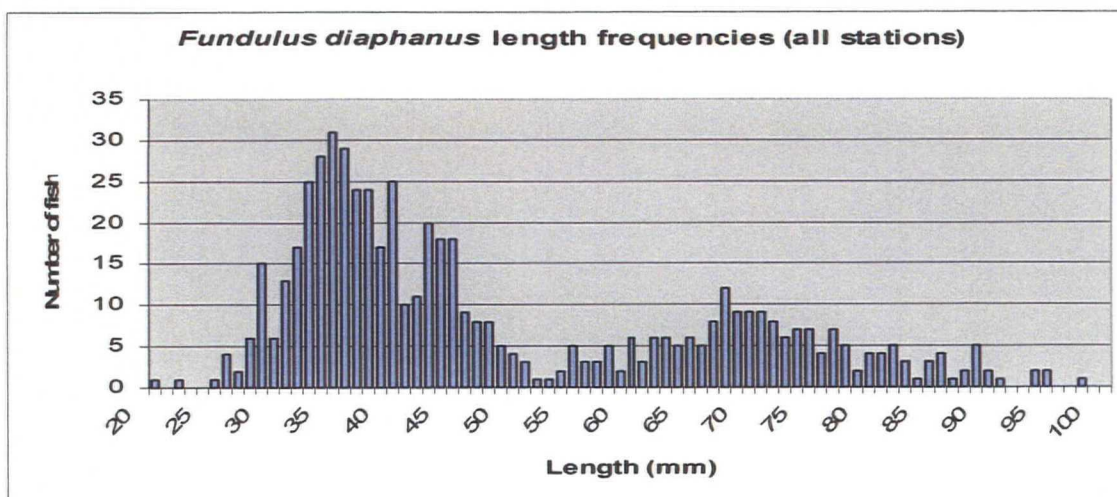


Figure 7. *Fundulus diaphanus* length frequencies in the study area.

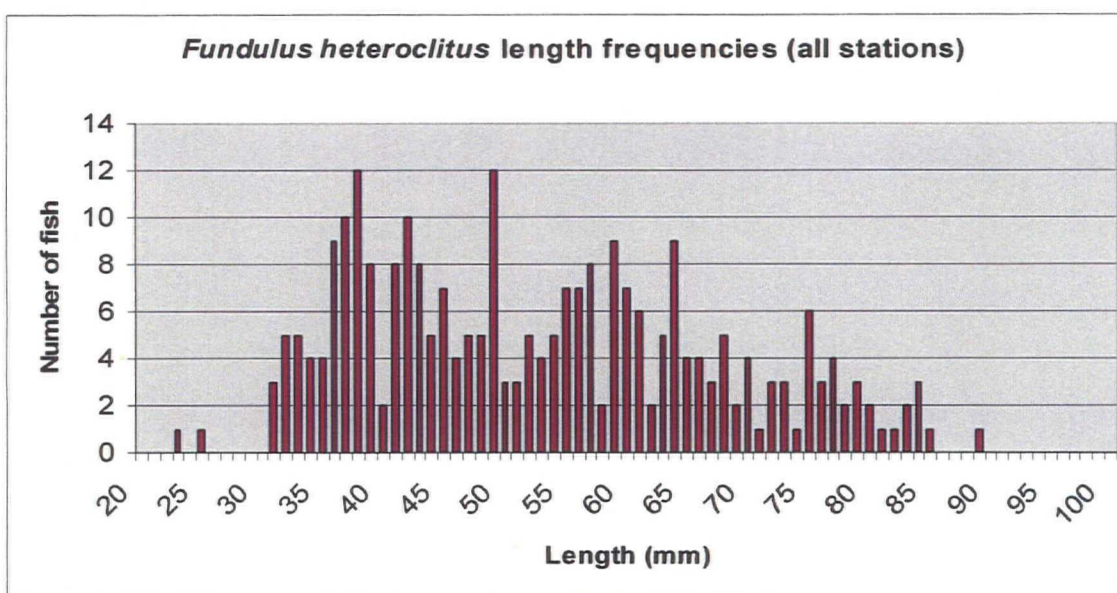


Figure 8. *Fundulus heteroclitus* length frequencies in the study area.

4.2 Benthic Macroinvertebrate Community Assessment

Berger conducted an assessment of the resident benthic macroinvertebrate communities to evaluate the ecological integrity of the aquatic system adjacent to the Site. Berger collected benthic macroinvertebrate samples from each of the seven stations within Hessian Run and the three stations within Woodbury Creek (Figure 1). The substrate composition throughout the study area is predominately silt and mud with underlying clay. Benthic cores were obtained by advancing a 100 mm by 100 mm hand-held square core 100 mm into the substrate at the water's edge at low tide. Three replicate samples were taken at each station, several feet apart from each other. Each sample was washed through a 0.5 mm sieve bucket and fixed in 95% ethanol. Samples were sorted in the field (Figure 9) and identified to the lowest practical taxon in the laboratory. Species abundance, number of species, and diversity of each replicate were recorded. Benthic macroinvertebrate species abundance, richness, diversity, trophic composition, and pollution tolerance for all stations is provided in Table 15. Raw benthic macroinvertebrate data and statistical summary appear in Appendices F and G.



Figure 9. Sorting benthic samples in the field.

Table 15. Benthic macroinvertebrate species abundance, richness, diversity, trophic composition, and pollution tolerance.

Species Abundance		Station										Stations 3, 4, 5 and 6	Reference Stations
Order/Class	Species/Taxa	1	2	3	4	5	6	7	8	9	10		
Oligochaeta	Oligochaete A	8	159	172	15	126	68	38	19	48	18	381	290
	Oligochaete B					19	3	4	4			22	8
Insecta	Odonata-Gomphidae	1											1
	Diptera-Chironomidae	41	70	38	13	46	85	15	19	2	19	182	166
Crustacea	Isopoda-Anthuridae		1								4		5
	Amphipod-Gammaridae	7							1				8
Bivalvia	Asian clam	50	21	12	1	11	2	1	5	4	6	26	87
	Unionidae	4	2										6
Hirudinea	Leech	2	3	3		1						4	5
Total		113	256	225	29	203	158	58	48	54	47	615	576
Species Richness													
(total species/taxa)		7	6	4	3	5	4	4	5	3	4	5	9
Shannon-Weaver Diversity Index													
(mean of station replicates)		0.526	0.414	0.372	0.284	0.420	0.325	0.332	0.526	0.162	0.462	0.409	0.522
Trophic Composition													
% deposit feeders		49.6	89.8	93.3	96.6	94.1	98.7	98.3	89.6	92.6	87.2	95.1	82.8
% filter feeders		47.8	9.0	5.3	3.4	5.4	1.3	1.7	10.4	7.4	12.8	4.2	16.1
% carnivores		2.7	1.2	1.3	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.7	1.0
Pollution Tolerance													
% tolerant		89.4	98.8	100	100	100	100	100	97.9	100	91.5	100	96.5
% moderately tolerant		9.7	1.2	0	0	0	0	0	2.1	0	8.5	0	3.3
% sensitive		0.9	0	0	0	0	0	0	0	0	0	0	0.2

Species Richness and Diversity

Overall, nine benthic macroinvertebrate taxa were collected from the sediments of the 10 stations in the study area. All macroinvertebrates collected during this study are typically found in freshwater, with the exception of the isopod, which generally occurs in brackish or marine habitats. Five taxa were collected at stations adjacent to the site (Stations 3, 4, 5, and 6), while nine taxa were collected at the reference stations.

Macroinvertebrate diversity in both Hessian Run and Woodbury Creek was fairly low, with Oligochaetes, Chironomids, and the Asian clam comprising over 97% (1,162 of 1,191) of the individuals collected. Low numbers of five additional taxa (29 individuals in all) were collected: Gomphidae, Anthuridae, Gammaridae, Unionidae and Hirudinea. Macroinvertebrate diversity at stations in Hessian Run, as measured by the Shannon-Weaver Diversity Index, was generally in the range of that of Woodbury Creek stations. However, overall diversity of the stations adjacent to the Site (Stations 3, 4, 5, and 6) was lower than that of the reference stations in Hessian Run and Woodbury Creek. The mean macroinvertebrate diversity index at Stations 3, 4, 5, and 6 was 0.409, while the mean diversity of the reference sites upstream and downstream in Hessian Run and in Woodbury Creek was slightly higher at 0.522.

Trophic Composition

The trophic composition of the macroinvertebrate communities at stations in Hessian Run and Woodbury Creek are provided in Table 15. Trophic compositions are based on the percentage of individuals which are either deposit feeders (Oligochaetes, Chironomids, Anthurids, and Gammarids), filter feeders (Asian clam and Unionidae), or carnivores (Gomphidae and Hirudinea). Because of the dominance of Oligochaetes and Chironomids in the benthic macroinvertebrate communities of the study area, deposit feeders dominate these communities. The macroinvertebrate communities at Stations 3, 4, 5, and 6 in Hessian Run adjacent to the Site consisted almost entirely of deposit feeders (95%), with few filter feeders (4%) or carnivores (less than 1%). Macroinvertebrate communities at the reference stations in Hessian Run and Woodbury Creek also consisted primarily of deposit feeders (83%) and contained few carnivores (1%), but had considerably more filter feeders (16%) than Stations 3, 4, 5, and 6. As presented in Table 15, most of these filter feeders were collected at Stations 1 and 2, where the sediments were sandier than most other stations sampled in the study area, likely accounting for the higher numbers of juvenile clams.

Pollution Tolerance

The Rapid Bioassessment Protocol procedure used by NJDEP's Bureau of Freshwater and Biological Monitoring is based on the USEPA's Rapid Bioassessment Protocols for use in Streams and Wadeable Rivers (EPA 841-B-99-002 Nov. 1999). This procedure involves the use of a net to collect insects, mollusks, and crustaceans in stream bottoms. The data analysis scheme calculates an impairment score based on five metrics, two of which are measures of the abundance of EPT taxa (Ephemeroptera, Plecoptera, and Trichoptera, commonly known as mayflies, stoneflies, and caddisflies) which are pollution sensitive. Because of the tidal nature of the study area and the predominance of silty sediments in the streambeds, macroinvertebrates in the study area are generally infauna which cannot be collected by net. Additionally, no EPT taxa were found in the macroinvertebrate communities of the study area. Therefore, the USEPA protocol is not appropriate to characterize the health of tidal streams with soft bottoms as those encountered during this study.

No single document was found which rated the pollution tolerance of the various macroinvertebrate taxa observed in the study area, however, several reports were used to develop estimations of relative tolerance by each taxa. These sources include Gosner (1977), USDA (1999), and USEPA (1990). Pollution tolerance, as shown in Table 15, is based on the assumption that Oligochaetes, the Asian clam, and Hirudinea are tolerant; Unionidae, Anthuridae and Gammaridae are moderately tolerant; and Gomphidae are sensitive to pollution. The macroinvertebrate communities at Stations 3, 4, 5, and 6 were entirely composed of tolerant organisms. The communities of reference stations upstream and downstream in Hessian Run and in Woodbury Creek were composed primarily of tolerant taxa (96.5%), but also contained some moderately tolerant taxa (3.3%) and a single sensitive individual.

5.0 TISSUE ANALYSIS

In order to assess the potential for food chain bioavailability and bioaccumulation of lead and PCBs from the project site, Berger conducted tissue analysis on specimens representing various trophic levels within the study area. Four components were analyzed: fish tissue (two trophic levels), wetland vegetation tissue (two species), benthic invertebrate tissue from wetland soils, and invertebrate tissue from upland soils. Approximately 20 - 50 grams of tissue of each species were collected per replicate from each station for tissue analysis.

5.1 Fish Tissue

Berger conducted tissue analysis on *F. diaphanus* (whole fish) for ecological risk assessment. Three replicate samples were collected at each of three on-site stations (Stations 3, 4, and 5) and three replicates were collected from each of three stations located within Woodbury Creek (Stations 8, 9, and 10). The pumpkinseed, *Lepomis gibbosus*, a fish consumed by humans, provided tissue for assessment of risk to human health, although due to the small size of the individuals caught, it was not possible to sample edible portions of this species, so whole fish were analyzed. Additionally, very few *L. gibbosus* were caught in Hessian Run (only one tissue sample was collected at Station 4) and at Station 9 in Woodbury Creek. Tables 16 and 17 present the concentrations of lead and several PCB congeners found in the tissue of *F. diaphanus* and *L. gibbosus* in the study area. No disease or anomalies were observed among fish submitted for tissue collection, but it was noted that some larger *F. diaphanus* and *F. heteroclitus* individuals had red lesions around the mouths or gills. At the request of NJDEP, a single sample comprised of *F. heteroclitus* individuals affected by lesions was submitted for tissue sampling (see Table 18). Additionally, a sample of live *F. heteroclitus* bearing lesions was submitted to NJDEP fish pathologists for their examination; the results are provided in Appendix H.

Table 16. Concentrations of lead and PCB congeners in tissue of *Fundulus diaphanus*.

<i>Fundulus diaphanus</i>		Contaminants (ppm)							
Station	Sample ID	Lead	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
3	3F1	1.5	0.015U	0.015U	0.015U	0.015U	0.036	0.19	0.067
	3F2	1.6	0.015U	0.015U	0.015U	0.015U	0.032	0.17	0.061
	3F3	1.6	0.025U	0.025U	0.025U	0.025U	0.043J	0.25	0.087
4	4F1F	0.78	0.05U	0.05U	0.05U	0.05U	0.1J	0.38J	0.13
	4F2F	0.78	0.025U	0.025U	0.025U	0.025U	0.068J	0.3J	0.16
	4F3F	0.7	0.025U	0.025U	0.025U	0.025U	0.056	0.24J	0.11J
5	5F1F	0.99	0.05U	0.05U	0.05U	0.05U	0.074	0.44J	0.16
	5F2F	1.2	0.05U	0.05U	0.05U	0.05U	0.069	0.39	0.16
	5F3F	0.82	0.025U	0.025U	0.025U	0.025U	0.09	0.26	0.075
8	8F1	0.7	0.025U	0.025U	0.025U	0.025U	0.053	0.18J	0.091
	8F2	0.71	0.015U	0.015U	0.015U	0.015U	0.038	0.12J	0.078J
	8F3	0.69	0.025U	0.025U	0.025U	0.025U	0.053	0.19J	0.11J
9	9F1	0.85	0.025U	0.025U	0.025U	0.025U	0.062	0.26	0.097
	9F2	0.86	0.025U	0.025U	0.025U	0.025U	0.057J	0.17J	0.1J
	9F3	1.4	0.015U	0.015U	0.015U	0.015U	0.048	0.14J	0.078
10	10F1	0.37	0.05U	0.05U	0.05U	0.05U	0.075	0.3	0.18
	10F2	0.46	0.025U	0.025U	0.025U	0.025U	0.071	0.24J	0.14
	10F3	0.39	0.025U	0.025U	0.025U	0.025U	0.061	0.24J	0.14

U = not detected above the sample quantitation limit (SQL)

J = Estimated concentration

Bolded values indicate positive detections

Table 17. Concentrations of lead and PCB congeners in tissue of *Lepomis gibbosus*.

<i>Lepomis gibbosus</i>		Contaminants (ppm)							
Location	Sample ID	Lead	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
Hessian Run (Station 4)	4F1L	0.6	0.025U	0.025U	0.025U	0.025U	0.081	0.24J	0.12
	4F2L	0.52	0.015U	0.015U	0.015U	0.015U	0.068	0.14J	0.069
	4F3L	0.47	0.05U	0.05U	0.05U	0.05U	0.1	0.27J	0.29J
Woodbury Creek (Station 9)	9F1L	0.17J	0.01U	0.01U	0.01U	0.01U	0.035	0.12	0.072
	9F2L	0.28	0.025U	0.025U	0.025U	0.025U	0.11	0.28	0.092
	9F3L	0.61	0.025U	0.025U	0.025U	0.025U	0.082	0.2	0.076

U = not detected above the sample quantitation limit (SQL)

J = Estimated concentration

Bolded values indicate positive detections

Table 18. Concentrations of lead and PCB congeners in tissue of *Fundulus heteroclitus* with lesions around the mouth or gills.

<i>Fundulus heteroclitus</i>		Contaminants (ppm)							
Location	Sample ID	Lead	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
Hessian Run	HRF	0.56	0.025U	0.025U	0.025U	0.025U	0.079	0.18	0.068

U = not detected above the sample quantitation limit (SQL)

J = Estimated concentration

Bolded values indicate positive detections

As depicted in Figure 10, concentrations of lead detected in *Fundulus diaphanus* from stations in Hessian Run adjacent to the Site and from Woodbury Creek reference stations were similar, with mean concentrations ranging from approximately 0.5 to 1.5 ppm. Concentrations of the three PCBs detected in *Fundulus diaphanus* from stations in Hessian Run adjacent to the Site and from Woodbury Creek reference stations were also similar, with mean concentrations ranging from approximately 0.05 to 0.35 ppm.

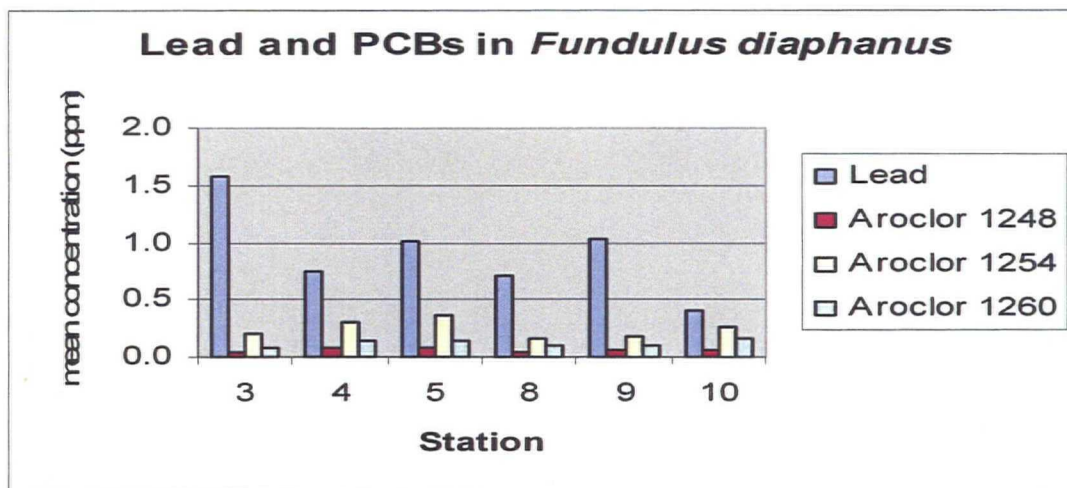
**Figure 10. Mean lead and PCB concentrations detected in *Fundulus diaphanus*.**

Figure 11 depicts the mean lead and PCB concentrations detected in *Fundulus heteroclitus* and *Lepomis gibbosus* in the study area. Concentrations of both lead and PCBs detected in *Fundulus heteroclitus* in Hessian Run adjacent to the Site were less than 0.6 ppm. These values are in the range of concentrations of these contaminants found in *Fundulus diaphanus* in both Hessian Run and Woodbury Creek. Concentrations of lead and PCBs detected in *Lepomis gibbosus* in Hessian Run adjacent to the Site were also low, and were similar to concentrations found in this species in Woodbury Creek, with mean concentrations ranging from approximately 0.1 to 0.5 ppm.

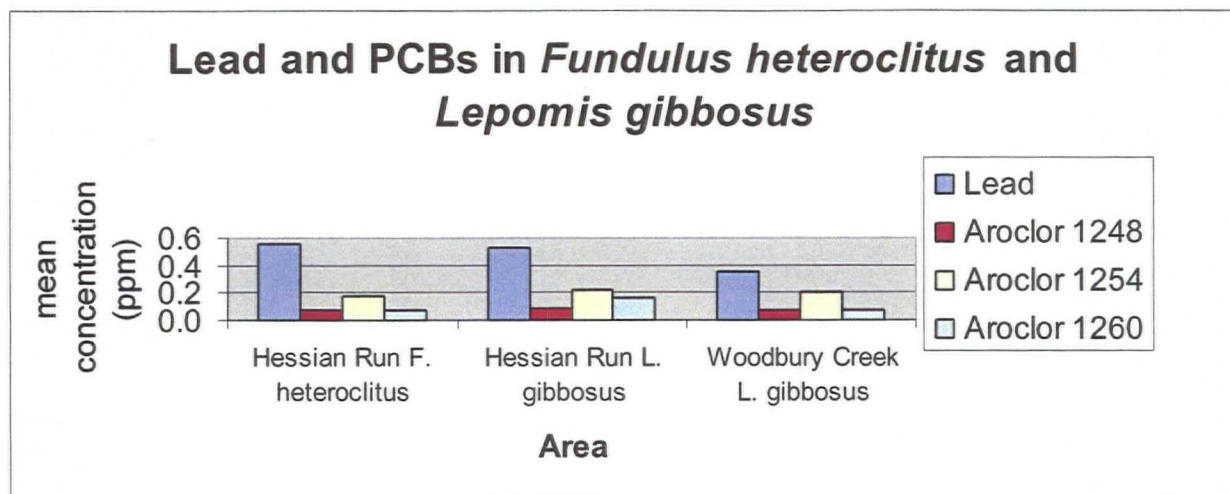


Figure 11. Mean lead and PCB concentrations detected in *Fundulus heteroclitus* and *Lepomis gibbosus* in the study area.

While lead and three PCB congeners were detected in fish species of different trophic levels at both the reference stations and stations in Hessian Run adjacent to the Site, the concentrations of these contaminants were less than 1 ppm. Concentrations of these contaminants in fish tissue at reference stations and stations adjacent to the Site were similar. Because Hessian Run drains almost completely at low tide, most fish caught there are probably transients and thus are not exposed to potential contaminants for significant periods.

Growth of juvenile brook trout (the same trophic level as *Lepomis gibbosus*) was not affected by whole-body tissue concentrations of lead ranging from 2.5 to 5.1 ppm (Jarvinen and Ankley 1999). These reported no-effect values are several times higher than those observed in *L. gibbosus* in the study area (less than 1 ppm), so no effects on growth are expected as a result of lead contamination from the site. No published data were available to compare tissue lead concentrations of fish from the same trophic level as *Fundulus diaphanus*, but the observed concentrations were also lower than the no-effect level reported for brook trout.

Most PCB contamination studies in fish have focused on the effects of Aroclor 1254. Survival and growth of juvenile rainbow trout was not affected by whole-body tissue concentrations of Aroclor 1254 of 81 ppm (Jarvinen and Ankley 1999). This reported no-effect value for Aroclor 1254 is much higher than those observed in *L. gibbosus* in the study area (less than 1 ppm). Aroclor 1248 and 1260 were detected in *L. gibbosus* in the study area in similarly low concentrations, so no effects on growth are expected as a result of contamination from these PCBs from the site.

Survival and growth of adult fathead minnows (the same trophic level as *F. diaphanus*) was not affected by whole-body tissue concentrations of Aroclor 1254 ranging from 741 to 1253 ppm (Jarvinen and Ankley 1999). These reported no-effect values for Aroclor 1254 are much higher than those observed in *F. diaphanus* in the study area (less than 1 ppm). Aroclor 1248 and 1260 were detected in *F. diaphanus* in the study area in similarly low concentrations, so no effects on survival or growth are expected as a result of contamination from these PCBs from the site.

The USEPA has established guidance for assessing chemical contaminant data for use in fish advisories (USEPA 2000). This guidance does not include screening for lead. The PCB screening in the guidance is for total PCBs. This study investigated fish tissue contamination of seven PCB congeners, but total PCB concentrations in fish tissue were not measured. Additionally, the screening is based on edible portions,

which were not obtained during the study due to the small size of the fish caught. Because of this, our data are not directly comparable with the EPA screening guidance.

The mean combined concentrations of Aroclor 1248, 1254, and 1260 in whole-body tissue of *L. gibbosus* in Hessian Run was 0.459 ppm, and in Woodbury Creek it was 0.356 ppm. USEPA's fish consumption guidance for noncancer health endpoints recommends that fish tissue with total PCB concentrations exceeding 0.38 ppm should not be consumed (fish meals per month=none (less than 0.5)). For cancer health endpoints, the guidance recommends that there should be no consumption of fish tissue with total PCB concentrations exceeding 0.094 ppm (fish meals per month=none (less than 0.5)). Whole-body tissue of *L. gibbosus* in both Hessian Run and Woodbury Creek exceeded both USEPA's noncancer and cancer health endpoints for any fish consumption.

5.2 Benthic Macroinvertebrate Tissue

Berger conducted benthic macroinvertebrate tissue analysis on the Asian clam (*Corbicula fluminea*) for ecological risk assessment. Three replicate samples were collected at each of three on-site stations (Stations 3, 4, and 5) and three replicates were collected from each of three stations located within Woodbury Creek (Stations 8, 9, and 10). Asian clams were collected from the substrate with the use of a rake and sieve with $\frac{1}{4}$ inch mesh (Figure 12). As each clam contained approximately 0.08 g of tissue, 250 clams were collected per sample in order to collect the minimum target sample of 20 g. Table 19 presents the concentrations of lead and several PCB congeners found in the tissue of the Asian clam in the study area.



Figure 12. Collecting Asian clams for tissue contaminant analysis.

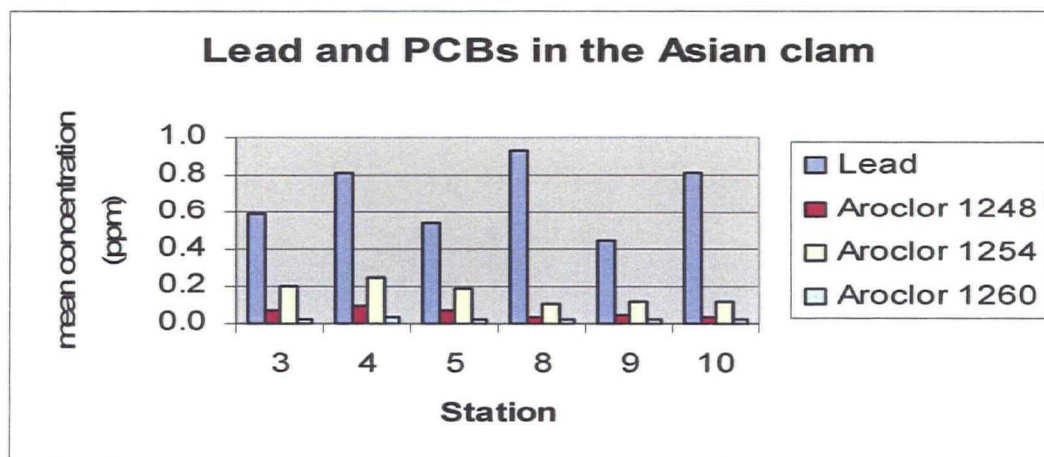
As depicted in Figure 13, concentrations of lead detected in the Asian clam at stations in Hessian Run adjacent to the Site and from Woodbury Creek reference stations were similar, with mean concentrations ranging from approximately 0.4 to 0.9 ppm. Concentrations of the three PCB congeners detected in the Asian clam were also similar at stations in Hessian Run and Woodbury Creek, with mean concentrations of less than 0.3 ppm. While the Asian clam is truly a resident of stations adjacent to the Site, it feeds on plankton transported by the tide which are not exposed to potential on-Site contaminants present in the sediment, and as such, the clam's tissues have low concentrations of these contaminants.

Table 19. Concentrations of lead and PCB congeners in tissue of the Asian clam.

Asian Clam		Contaminant (ppm)							
Station	Sample ID	Lead	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
3	3B1	0.79	0.025U	0.025U	0.025U	0.025U	0.066J	0.19	0.032J
	3B2	0.54	0.025U	0.025U	0.025U	0.025U	0.07	0.19	0.025U
	3B3	0.44	0.025U	0.025U	0.025U	0.025U	0.078	0.22	0.026
4	4B1	0.78	0.025U	0.025U	0.025U	0.025U	0.084	0.23	0.029
	4B2	0.73	0.025U	0.025U	0.025U	0.025U	0.1	0.26	0.033
	4B3	0.91	0.025U	0.025U	0.025U	0.025U	0.1	0.26	0.036
5	5B1	0.52	0.025U	0.025U	0.025U	0.025U	0.072	0.2	0.026
	5B2	0.53	0.025U	0.025U	0.025U	0.025U	0.062	0.18	0.0250U
	5B3	0.59	0.025U	0.025U	0.025U	0.025U	0.066	0.18	0.0250U
8	8B1	1.3	0.025U	0.025U	0.025U	0.025U	0.041J	0.12	0.025U
	8B2	0.57	0.015U	0.015U	0.015U	0.015U	0.034J	0.093	0.021
	8B3	0.92	0.015U	0.015U	0.015U	0.015U	0.035J	0.1	0.021
9	9B1	0.38	0.01U	0.01U	0.01U	0.01U	0.029	0.082	0.013
	9B2	0.46	0.015U	0.015U	0.015U	0.015U	0.047	0.14	0.022
	9B3	0.5	0.015U	0.015U	0.015U	0.015U	0.048	0.14J	0.024
10	10B1	0.86	0.025U	0.025U	0.025U	0.025U	0.046J	0.13	0.032
	10B2	0.56	0.025U	0.025U	0.025U	0.025U	0.047J	0.13	0.027J
	10B3	1	0.015U	0.015U	0.015U	0.015U	0.03J	0.091	0.025J

U = not detected above the sample quantitation limit (SQL)

J = Estimated concentration

Bolded values indicate positive detections**Figure 13. Mean lead and PCB concentrations detected in the Asian clam in the study area.**

5.3 Upland Invertebrate Tissue

Berger collected three replicate earthworm (*Lumbricus* spp.) samples from three stations within upland soil on the project site and one off-site reference station for ecological risk assessment. The sample

station locations are depicted on Figure 1. Earthworm samples were collected using shovels. Upon collection, earthworms were rinsed with distilled water to remove associated soil particles. In the laboratory, the whole earthworms were homogenized and sampled for the contaminants of concern. Earthworms were not dissected and no depuration of earthworm guts was undertaken.



Figure 14. Taking position of earthworm collection site with GPS.

Table 20 shows the concentrations of lead and several PCB congeners found in the tissue of earthworms in the study area. No disease or anomalies were observed among earthworms.

Table 20. Concentrations of lead and PCB congeners in earthworm tissue.

Earthworm		Contaminant (ppm)							
Station	Sample ID	Lead	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
4E	4E1	441	0.50U	0.50U	0.50U	0.50U	0.50U	2.9	3.1
	4E2	400	0.50U	0.50U	0.50U	0.50U	0.50U	2.4	2.4J
	4E3	511	0.50U	0.50U	0.50U	0.50U	0.50U	2.1	3.2J
4.5E	4.5E1	339	0.50U	0.50U	0.50U	0.50U	0.50U	3.5	5.6
	4.5E2	269	0.50U	0.50U	0.50U	0.50U	0.50U	2.5	4
	4.5E3	414	0.50U	0.50U	0.50U	0.50U	0.50U	2.5	3.2
5E	5E1	1,090	0.075U	0.075U	0.075U	0.075U	0.075U	0.62	0.37
	5E2	1,150	0.10U	0.10U	0.10U	0.10U	0.10U	0.69	0.37
	5E3	1,100	0.10U	0.10U	0.10U	0.10U	0.10U	0.73	0.36
8E	8E1	4.5	0.005U	0.005U	0.005U	0.005U	0.005U	0.012J	0.005U
	8E2	25.1	0.025U	0.025U	0.025U	0.025U	0.025U	0.12J	0.025U
	8E3	5.9	0.005U	0.005U	0.005U	0.005U	0.005U	0.014	0.005U

U = not detected above the Sample Quantitation Limit (SQL)

J = Estimated concentration

Bolded values indicate positive detections

Figure 15 depicts the mean lead concentrations detected in earthworm tissue within the study area. Mean concentrations of lead detected in earthworm tissue at on-Site stations ranged from approximately 340 to 1,100 ppm, while the mean concentration at the reference station was only 12 ppm. Figure 16 depicts the mean PCB concentrations in earthworm tissue within the study area. Mean concentrations of the two PCB congeners detected in earthworms at on-Site stations ranged from approximately 0.4 to 4 ppm, while only one of these congeners was detected in earthworms at the reference station, and at a much lower mean concentration of about 0.05 ppm. Lead was detected in earthworms at the on-Site stations in mean concentrations 20 times greater than that of the reference station. PCBs were detected in earthworms at the on-Site stations in mean concentrations eight times greater than that of the reference station.

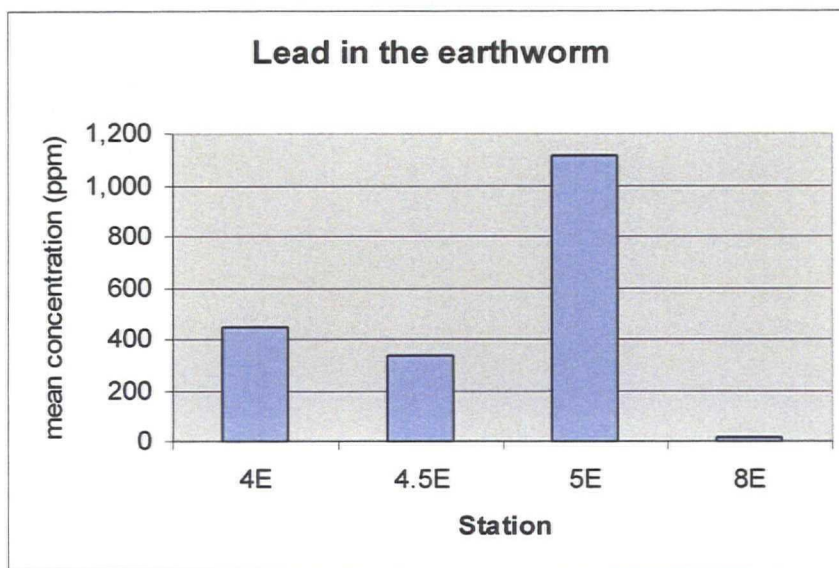


Figure 15. Mean lead concentrations detected in earthworm tissue in the study area.

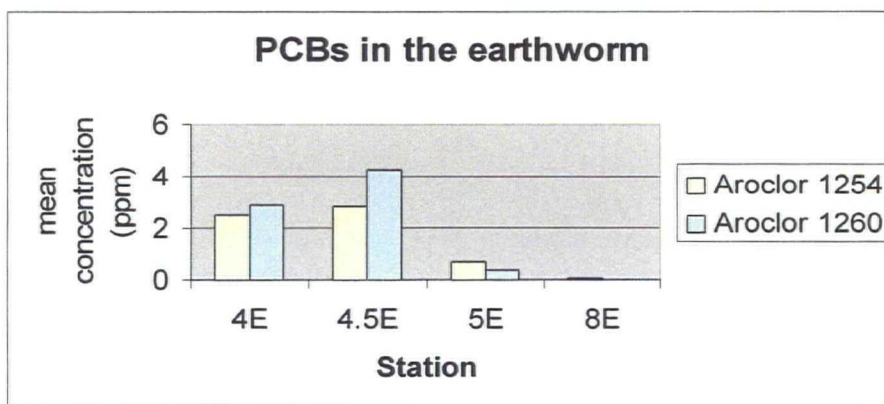


Figure 16. Mean PCB concentrations detected in earthworm tissue in the study area.

Soil samples were not collected for analysis at the time of this study's earthworm sampling event, however, eight soil samples were collected and analyzed for lead from test pits during the previous RI investigations in the vicinity of the earthworm sampling Stations 4E, 4.5E and 5E. Those eight soil samples were collected at depths ranging from 0-3 feet bgs, and exhibited elevated lead concentrations ranging from a minimum of 821ppm to a maximum of 31,300, and the mean lead concentration was 11,600ppm. All of these lead contaminated soil samples were collected in areas containing observed

buried and surface battery casings and other mixed waste materials, as were the earthworm tissue samples exhibiting elevated lead and PCB concentrations at Stations 4E, 4.5E and 5E. Although no previous soil samples had been collected near earthworm Station 8E (which exhibited much lower lead and PCB concentrations), no battery casings or other mixed waste were observed at this location. Since lead and PCB concentrations in earthworm tissue were reported high in areas containing battery casings or other mixed waste, and much lower where waste was not observed, there appears to be a direct correlation between lead in earthworms and the presence or absence of site related waste materials. Although the previous RI soil samples collected near the earthworm tissue stations were not analyzed for PCBs, the same correlation can be drawn between the observed presence or absence of waste and elevated PCBs concentrations in tissue.

5.4 Wetland Plant Tissue

Berger conducted tissue analyses on the wetland plants wild rice (*Zizania aquatica*) and spatterdock (*Nuphar luteum*), which were common in Hessian Run and along the shorelines of Woodbury Creek. Three replicate samples of each species were collected at each of three on-site stations in Hessian Run (Stations 4, 5 and 6) and at one reference station within Woodbury Creek (Station 8). For both spatterdock and wild rice, the tissue collection consisted of above-ground portions of vegetation. Careful attention during the field collection process ensured that only vegetation which was free of sediment was collected. Spatterdock samples were composed of stems and leaves, while wild rice samples consisted of stems, leaves, and seedheads.

Tables 21 and 22 show the concentrations of lead and several PCB congeners found in the tissue of wild rice and spatterdock in the study area.

Table 21. Concentrations of lead and PCB congeners in tissue of the wetland plant spatterdock.

Spatterdock		Contaminant (ppm)							
Station	Sample ID	Lead	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
4	4PN1	9.8	0.005U	0.005U	0.005U	0.005U	0.005U	0.015J	0.0083
	4PN2	4.8	0.005U	0.005U	0.005U	0.005U	0.005U	0.0095J	0.005U
	4PN3	5.2	0.005U	0.005U	0.005U	0.005U	0.005U	0.012J	0.0053
5	5PN1	8.4	0.005U	0.005U	0.005U	0.005U	0.005U	0.015J	0.008
	5PN2	6.7	0.005U	0.005U	0.005U	0.005U	0.005U	0.014J	0.0076
	5PN3	7.6	0.005U	0.005U	0.005U	0.005U	0.005U	0.013J	0.0058
6	6PN1	4.9	0.005U	0.005U	0.005U	0.005U	0.005U	0.0088J	0.005U
	6PN2	5.5	0.005U	0.005U	0.005U	0.005U	0.005U	0.01J	0.0051
	6PN3	3.9	0.005U	0.005U	0.005U	0.005U	0.005U	0.0094J	0.005U
8	8PN1	1.5	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
	8PN2	1.4	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
	8PN3	1.6	0.005U	0.005U	0.005U	0.005U	0.027	0.005U	0.005U

U = not detected above the sample quantitation limit (SQL)

J = Estimated concentration

Bolded values indicate positive detections

Table 22. Concentrations of lead and PCB congeners in tissue of the wetland plant wild rice.

Wild Rice		Contaminant (ppm)							
Station	Sample ID	Lead	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
4	4PZ1	2.2	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
	4PZ2	6.1	0.005U	0.005U	0.005U	0.005U	0.005U	0.007J	0.005U
	4PZ3	5.6	0.005U	0.005U	0.005U	0.005U	0.005U	0.0052J	0.005U
5	5PZ1	1.3	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
	5PZ2	3.5	0.005U	0.005U	0.005U	0.005U	0.005U	0.0062	0.005U
	5PZ3	1.8	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
6	6PZ1	8.2	0.005U	0.005U	0.005U	0.005U	0.005U	0.012J	0.0073J
	6PZ2	6	0.005U	0.005U	0.005U	0.005U	0.005U	0.0084J	0.005U
	6PZ3	7.1	0.005U	0.005U	0.005U	0.005U	0.005U	0.014J	0.0074J
8	8PZ1	0.33	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
	8PZ2	0.36	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
	8PZ3	0.23J	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U

U = not detected above the sample quantitation limit (SQL)

J = Estimated concentration

Bolded values indicate positive detections

Both lead and PCBs were detected in the two wetland plant species at stations adjacent to the Site. Figure 17 depicts mean lead concentrations detected in wetland plants in the study area. Mean concentrations of lead detected in the wetland plants spatterdock and wild rice at stations in Hessian Run adjacent to the Site ranged from approximately 2 to 7 ppm, while the mean concentrations in these plants at the Woodbury Creek reference station were less than 2 ppm. Figures 18 and 19 depict mean PCB concentrations in spatterdock and wild rice in the study area. Mean concentrations of the two PCB congeners detected in these two wetland plants at stations in Hessian Run adjacent to the Site ranged from approximately 0.005 to 0.015 ppm, while neither of these two congeners was detected in the tissue of these plant species at the Woodbury Creek reference station.

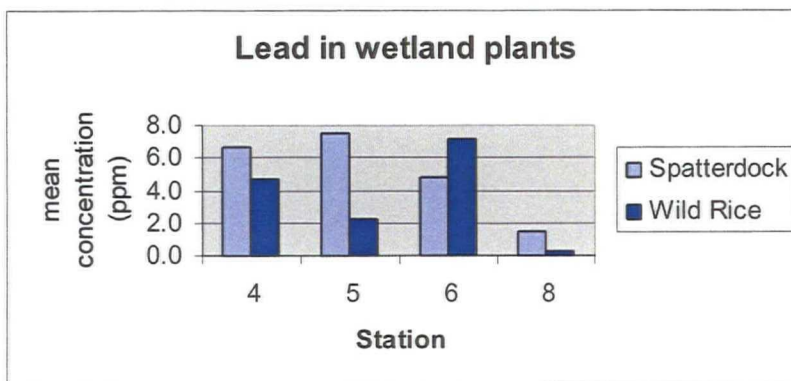


Figure 17. Mean lead concentrations detected in wetland plants in the study area.

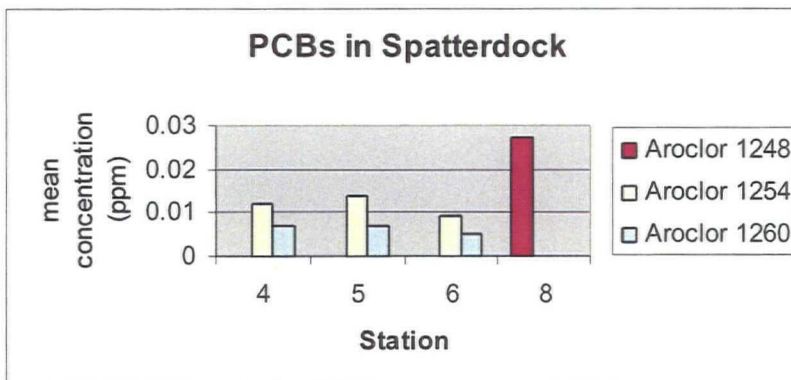


Figure 18. Mean PCB concentrations detected in spatterdock in the study area.

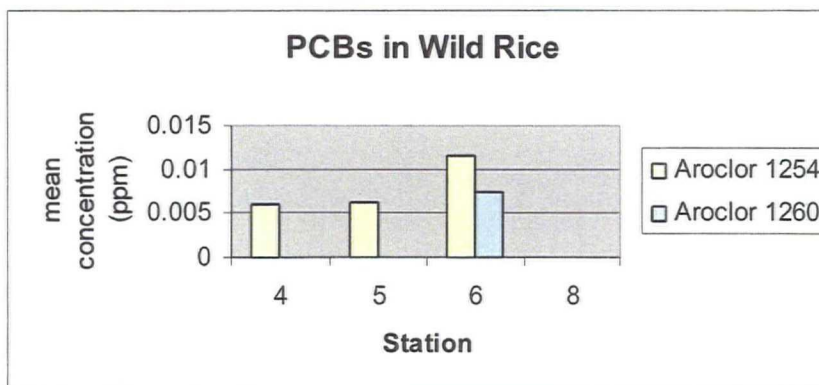


Figure 19. Mean PCB concentrations detected in wild rice in the study area.

6.0 CONCLUSIONS

The dissolved oxygen levels and pH of surface water at Site stations (Stations 3, 4, 5, & 6) in Hessian Run met the state criteria for FW2 waters. Concentrations of total recoverable lead at all Site stations were below the acute aquatic life protection standard, but three of the four Site stations (3, 5, and 6) exceeded the chronic aquatic life protection criteria. Sediment sampling revealed that concentrations of lead in sediments at all Site stations were greater than lead concentrations at all reference stations. Sediment lead concentrations exceeded the Lowest Effects Level (LEL) at all Site stations, and lead concentrations at three of four Site stations (3, 4, and 6) also exceeded the Severe Effects Level (SEL). While lead concentrations at station 6 only slightly exceeded the SEL, lead concentrations at stations 3 and 4, respectively, greatly exceeded the SEL by 1 to 1.75 orders of magnitude. Based on results presented in the recent Remedial Investigation Report (RIR – Berger, 2004), the locations of stations 3 and 4 coincide with those of the heaviest concentrations of lead bearing battery casings previously deposited along the Hessian Run shoreline. Concentrations of Aroclor 1254 and Aroclor 1260 detected at all four Site stations exceeded the LEL, but did not exceed the SEL. Concentrations of these two PCB congeners at Site Station 4 were approximately ten times higher than concentrations detected at all other stations. Site Station 4 also contained another PCB that was not detected at any other station in the study area.

Sediment toxicity testing through acute exposure experiments indicated elevated toxicity of some Site station sediments relative to reference stations and control sediment. Sediments from Station 4 resulted in 100% mortality of amphipod test organisms, while Site Station 6 had significantly less test organism survival than the control sediment. Survival and growth at the other two Site stations (3 and 5) were not significantly different than survival in the control sediment. In the midge testing, sediment from Site Station 4 again resulted in 100% mortality of test organisms, while the other three Site stations all had significantly less test organism survival than control sediment. In both the amphipod and midge testing, several of the reference sites also had significantly less survival than control sediment. Chronic exposure experiments using larval midges as test organisms resulted in significantly less adult emergence at three of the four Site stations than the reference stations. Site Station 3 also had a significantly greater number of days before first emergence than the reference stations.

Four fish species were caught at Site stations, while twelve species were caught at the reference stations. Mean fish diversity at the four Site stations was considerably lower than at the six reference stations upstream and downstream in Hessian Run and in Woodbury Creek. The fish communities at the Site stations consisted almost entirely of omnivores, whereas fish communities at the reference stations, while also primarily composed of omnivores, had a greater percentage of water-column feeders and top carnivores. In addition, three species not encountered in a 1977 fish survey of the study area (Hastings and Good, 1977) were caught during this study.

Five benthic macroinvertebrate taxa were collected at the Site stations, while nine taxa were collected at the reference stations. Mean taxa diversity of the Site stations was slightly lower than that of the reference stations. The benthic macroinvertebrate communities at the Site stations and reference stations consisted almost entirely of deposit feeders, with few filter feeders or carnivores. Benthic taxa at the reference stations were primarily pollution-tolerant, but some moderately tolerant and sensitive taxa were present, while Site stations consisted entirely of pollution-tolerant organisms.

Similar concentrations of lead were detected in fish and clam tissue from Site stations and Woodbury Creek reference stations. PCBs were detected in fish and clam tissue from Site stations and Woodbury Creek reference stations at similar concentrations. Concentrations of lead detected in the wetland plants spatterdock and wild rice at Site stations were considerably higher than those of the Woodbury Creek

reference stations. Concentrations of two PCB congeners (Aroclor 1254 and Aroclor 1260) detected in these plant species at Site stations were also considerably higher than at the reference stations. In earthworm tissue, lead concentrations at the Site stations were over ten times greater than at the reference station. Concentrations of the two PCB congeners detected in earthworms at Site stations were also much higher than at the reference station.

In summary, concentrations of total recoverable lead in surface water samples at three of the four Site stations (3, 5, and 6) exceeded NJDEP's chronic aquatic life protection criteria. Sediment lead concentrations at three of the four Site stations (3, 4, and 6) exceeded NJDEP's SEL values. Sediments at Site Stations 3 and 4, which both had sediment lead concentrations of over 2,000 ppm, exhibited high benthic organism toxicity relative to other stations in the study area; station 4 exhibited the highest mortality rate (100% mortality) for both amphipods and midges. These two stations with high lead concentrations and toxicity levels are located immediately adjacent to the heaviest concentrations of shoreline battery casing deposits (see Figure 20). As evidenced by the field assessment results, benthic organisms do occur in the sediment at Site Stations 3, 4, 5, and 6, albeit at lower diversity than the reference stations. However, benthic organisms in fine-grained sediment such as that present in the study area typically occur within the top few centimeters of sediment. Because the sediment used for sediment contaminant sampling and sediment toxicity testing was collected from a composited depth of 0-6", the deeper portion of the sample may contain contaminant levels toxic to the benthos. Consequently, disturbance and exposure of deeper sediment containing high levels of contaminants would adversely impact the aquatic biota.

Concentrations of lead and PCBs in fish and clam tissue were similar at the Site and reference stations. This result is not unexpected, considering the natural history of the organisms. Fish are mobile and unlike the benthos, are not resident at a particular station. Therefore, they would not be exposed exclusively to water and sediment quality conditions at a particular site. The clams are resident members of the benthic community, but are filter feeders. In addition, the relatively small size of the clams that were collected and analyzed indicates that the individuals represented a newly settled year class.

Lead and PCB concentrations in wetland plant tissue were much higher at the Site stations than the reference stations, suggesting that pollutants may be located more deeply in the sediment where plant roots can uptake them. Herbivores inhabiting this area would appear to be at risk of consuming plants with elevated concentrations of pollutants.

Earthworm tissue lead and PCB concentrations were much greater at the three upland Site stations (Stations 4E, 4.5E & 5E) than the off-site reference station (8E). The three lead and PCB impacted upland sampling stations were located within areas documented in the RIR (Berger, 2004) to contain surficial and buried mixed waste materials containing lead bearing battery casings and PCB contaminated soils. Earthworms are a major food source for shrews and moles, as well as a variety of bird species, and may represent a pathway through which lead and PCBs are passed onto higher trophic levels in the food chain.



SOURCE: NJDEP DIGITAL ORTHOPHOTOS, 1995/1997.



N.J. Department of
Environmental Protection

Matteo Iron and Metals, Gloucester County, New Jersey
SAMPLING STATION AND BATTERY CASING LOCATIONS
NJDEP CONTRACT No. A-85149


The Louis Berger Group, Inc.
 30 Vreeland Road
Florham Park, NJ

FIGURE 20

7.0 REFERENCES

- American Society for Testing and Materials. 2001. E-1706-00. *Test method for measuring the toxicity of sediment-associated contaminants with fresh-water invertebrates*.
- Berger. 2004. *Remedial Investigation Report for Matteo Iron and Metal Site*.
- Gosner, K.L. 1978. *A field guide to the Atlantic seashore*. Houghton Mifflin Co., Boston, MA. 329 pp.
- Hastings, R. W. and R.E. Good. 1977. *Population analysis of the fishes of a freshwater tidal tributary of the Lower Delaware River*. Rutgers University. Camden, NJ.
- Hauer, F. R. and G. A. Lamberti (eds). 1996. *Methods in stream ecology*. Academic Press, New York, 674 pp.
- Merritt, R. W. and K. W. Cummins (eds). 1996. *An introduction to the aquatic insects of North America*. Third Edition. Kendall/Hunt Publishing Company, Iowa, 862 pp.
- NJDEP. November 1998. *Guidance for Sediment Quality Evaluations*. Site Remediation Program, 29 pp.
- NJDEP, May 1992, *NJDEP Field Sampling Procedures Manual*.
- NJDEP, May 1997, *NJDEP Technical Requirements for Site Remediation (N.J.A.C. 7:26E)*.
- NJDEP, December, 1996. *Preliminary Assessment and Site Investigation Report, James Matteo & Sons, Inc., West Deptford, New Jersey*.
- Page, L. M. and B. M. Burr. 1991. *Freshwater Fishes*. Houghton Mifflin Co., New York, 432 pp.
- Pennak, R. W. 1989. *Fresh-water invertebrates of the United States: Protozoa to Mollusca*. Third Edition. John Wiley & Sons, Inc., New York. 628 pp.
- Shannon, C.E. and W. Weaver. 1949. *The Mathematical Theory of Communication*. The University of Illinois Press, Urbana, IL.
- Toxstat. March, 1994 Version 3.4 data analysis software published by West, Inc. Western EcoSystems Technology, Inc., Cheyenne, WY
- The Louis Berger Group, Inc. May 2001. *Draft Remedial Investigation Report for: Matteo Iron and Metal, West Deptford, New Jersey*. Statewide Contract No. A-85149.
- U.S. Department of Agriculture. 1999. *Stream Visual Assessment Protocol*. National Water and Climate Center Technical Note 99-1. Natural Resources Conservation Service.
- U.S. Environmental Protection Agency. November 1990. *Macroinvertebrate field and laboratory methods for evaluating the biological integrity of surface waters*. EPA/600/4 -90/030. Office of Research and Development, Washington, D.C. 256 pp.

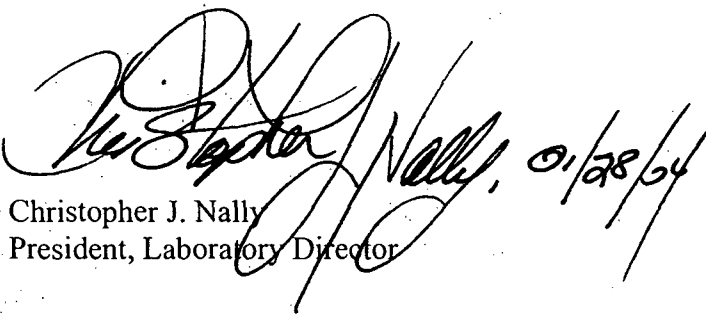
- U.S. Environmental Protection Agency. July 1999. *Rapid bioassessment protocols for use in wadeable streams and rivers*. EPA 841-B-99-002. Office of Water, Washington, D.C.
- U.S. Environmental Protection Agency. March 2000. *Methods for measuring the toxicity and bioaccumulation of sediment-associated contaminants with freshwater invertebrates*. EPA/600/R-99/064. Office of Research and Development, Office of Water, Washington, D.C.
- U.S., Environmental Protection Agency. 2000. Office of Water. *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories*. EPA 823-B-00-007.
- Weiss, H.M. 1995. *Marine animals of Southern New England and New York: Identification Keys to common nearshore and shallow water macrofauna*. State Geological and Natural History Survey of Connecticut. Bulletin 115.
- Weston, Roy F., Inc., October 1997. *Trip Report: Matteo Iron and Metal*.

Appendix A

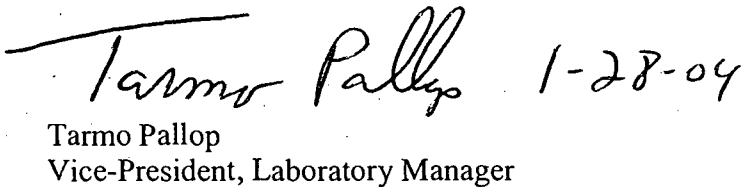
Sediment toxicity testing - *Hyalella azteca*

REPORT CERTIFICATION

The following report titled "THE LOUIS BERGER GROUP, INC. MATTEO IRON AND METALS SEDIMENT TOXICITY TESTING - *Hyalella azteca*" is an accurate and truthful representation of the toxicity testing which was performed by American Aquatic Testing, Inc., located at 1105 Union Blvd. Allentown, Pennsylvania. We further certify that we have personally examined and are familiar with the information submitted in this document and based on our inquiry of those individuals immediately responsible for obtaining the information, we believe the submitted information is complete as presented. We are aware that there are significant penalties for submitting false information.



Christopher J. Nally
President, Laboratory Director



Tarmo Pallop 1-28-04
Tarmo Pallop
Vice-President, Laboratory Manager

APPENDIX A

THE LOUIS BERGER GROUP, INC.
MATTEO IRON AND METALS
SEDIMENT TOXICITY TESTING – *Hyaella azteca*

Contents

<u>Section</u>	<u>Page</u>
Introduction	2
Materials and Methods; <i>Hyaella azteca</i>	2
Results	6

Tables

I.	Summary of Conditions for <i>Hyaella azteca</i> Toxicity Test	5
II.	Percent survival of <i>H. azteca</i> by replicate chamber and mean survival using control sample	6

Data

Raw data for *Hyaella azteca* 28-day survival and growth test

Statistical data for *Hyaella azteca* 28-day survival and growth test using control sediment

Chain of Custody Documentation

MATTEO IRON AND METALS SEDIMENT TOXICITY TESTING – *Hyalella azteca*

INTRODUCTION

During the month of August 2003, samples of sediment were collected from the Matteo Iron and Metals facility and surrounding area in Gloucester County, New Jersey. These sediment samples were used to perform toxicity tests to determine if the tested matrices represent a significant threat to potential receptor organisms.

The sediment samples from the study area were delivered to American Aquatic Testing, Inc. (AAT) and evaluated for toxicity using a 28-day solid phase exposure with the amphipod *Hyalella azteca* [1]. Following the exposure period, surviving test organisms from the sediments collected in the study area were compared to a control set tested under similar conditions using sediment of known environmental quality. The endpoints used for determination of an impact in the amphipod exposures were mortality, measured as mean survival, and growth, measured as mean dry weight.

MATERIALS AND METHODS / *Hyalella azteca*

Surface sediment samples were collected at stations adjacent to the Matteo Iron and Metals facility. Station locations were selected to represent areas that may have been impacted by the facility's operations. Sediment samples were also taken at stations in the surrounding area for the purpose of making reference comparisons.

Preparation of sediment samples for testing

The sediment samples collected on August 18, 19 and 20 2003, were transported to the Severn Trent Laboratories facility in Edison, NJ and picked up by AAT personnel on August 21, 2003. Samples were collected in 2.5-gallon high-density polyethylene (HDPE) containers and transported on ice. Upon arrival at AAT on August 21, 2003, the samples were refrigerated until being used for testing on September 3, 2003. These samples were not altered other than to remove large debris and organic material (larger than ~3 cm) before testing.

Control sediment used to assess the health of the test organisms used for testing was collected from the Spruce Run Reservoir in Clinton, NJ on August 26, 2003 and was screened on-site using a #18 mesh screen to remove large debris and indigenous organisms. Screened sediment was placed in a five gallon HDPE container for transport to the laboratory and refrigerated until used for testing on September 3, 2003. Control sediment was analyzed for grain size, and total organic carbon (TOC) by Severn Trent Laboratories in Edison, NJ. The results of these analyses are included at the end of this appendix.

Test organisms

Amphipods (*Hyaella azteca*) used for the study were obtained from stock cultures maintained by Aquatic Biosystems, Inc. of Fort Collins, CO and were received in-house on September 3, 2003. Prior to testing, the organisms were held under conditions similar to that which they would encounter during the test (see Table I). The amphipods were fed once daily a combination of yeast, cereal leaves and digested trout pellets (YCT) [1]. At the beginning of the 28-day exposure, the test organisms were 7 days old. The age group used to conduct this test did however fall within the acceptable age range for this procedure [1].

A reference toxicant test using potassium chloride was conducted concurrently with the 28-day exposure to assess the sensitivity of the lot of organisms used in the sediment test. The 48 hr LC₅₀ produced was 338.7 ppm. This test value falls within the acceptable range of the control chart being maintained by AAT for this test species. A copy of the raw data and the control chart are included.

Experimental procedures

The entire sediment exposure series for this project consisted of ten sediment samples from the study area and one of control sediment from Spruce Run Reservoir. Test chambers (300 mL tall form borosilicate glass beakers) were filled with 100 mL of sediment. 175 mL of test water was poured over the sediment gently to cause minimal disturbance. There were five replicate chambers for each station treatment. Test chambers were allowed to settle for 24 hours prior to test initiation.

After the settling period, the overlying water was siphoned off and fresh water was introduced, using a small, round HDPE disk suspended over the sediment to deflect the water flow and minimize disturbance to the sediment. Water quality data including alkalinity, ammonia, conductivity, dissolved oxygen, temperature, pH, and hardness were measured initially on composite water samples from all samples, prior to the introduction of test organisms, and at the end of the 28-day exposure for each sample and the control. Conductivity was also measured at 7, 14 and 21 days in all samples and the control. The dissolved oxygen, pH and temperature were also measured initially and every 24 hours thereafter for the duration of the exposure for each sample and the control.

The exposure period began by placing 10 randomly selected test organisms into each chamber. Care was taken to ensure that the organisms were released beneath the surface of the overlying water to keep air bubbles from forcing the organisms to the surface. Test chambers were not fed during this exposure. Test conditions are summarized in Table I.

Observations were made and recorded for each chamber each day during the exposure period to assess organism health. Observations included the number of organisms dead, swimming, on the surface of the sediment or on the surface of the water. Dissolved oxygen, pH and temperature were measured and recorded each day from a new replicate chamber for each sample and the control. During the 28 days of the test, each chamber would be used for recordings five times and three chambers would be used six times. 150 mL of the overlying water was siphoned off twice a day and replaced using reconstituted water as a measure to maintain sufficient dissolved oxygen levels. Care was taken to minimize disturbance of the sediment during water renewal by using the small HDPE disc.

At the end of the 28-day exposure the final alkalinity, ammonia, conductivity, hardness, dissolved oxygen, pH and temperature were measured, and the test chambers were prepared for the removal of test organisms. With the overlying water present in each chamber, the top 20% of sediment was gently stirred into suspension. The slurry was then poured into a #60 mesh screen (250 μ m) and rinsed in a shallow pan of laboratory water to remove the finer grains of the sediment. Sediment remaining in the sieve was placed into a second shallow pan of water over a light table, and carefully sorted to find the surviving test organisms. Using additional laboratory water, this process was repeated two or three times for each replicate until all the sediment had been inspected. All surviving organisms were transferred to a 30 mL soufflé cup for live count verification and preparation for weight determination.

When all test chambers had been sieved and the number of survivors verified, the test organisms were sacrificed using ethanol. The test organisms were then placed on tared aluminum weigh pans, which had been initially dried and weighed on October 1, 2003, dried for six hours at 105°C, and then transferred to a dessicator to cool before dry weight determination. Final dry weights were recorded on October 8, 2003.

Data analysis

Data analysis was performed following procedures published by the USEPA [1] using the Toxstat [2] data analysis software. Survival data, in the form of proportion of survivors in each chamber, was transformed by arcsine squareroot and then tested for normality using the Shapiro-Wilk's test or the Chi-Square test and for homogeneity of variance using Bartlett's test, as appropriate. Analysis of variance (ANOVA) followed by Dumett's *a posteriori* pairwise comparisons or Steel's Many-One Rank test, as appropriate, to evaluate differences between stations and the control sample.

TABLE I: Summary of Conditions for *Hyalella azteca* Toxicity Test

1.	Test type;	Whole sediment, static, daily renewal
2.	Temperature;	23.0 +/- 1.0 ° C
3.	Light quality;	Wide-spectrum fluorescent illumination
4.	Light intensity;	50 - 100 foot-candles
5.	Photoperiod;	16 hours light, 08 hours dark
6.	Test chamber size;	300 mL high form borosilicate glass beakers
7.	Sediment volume;	100 mL / replicate
8.	Overlying water volume;	175 mL / replicate
9.	Renewal;	2 volume exchanges per day
10.	Age of test organisms;	7 days
11.	Number organisms / container;	10
12.	Replicates;	5
13.	Feeding;	None
14.	Aeration;	None unless dissolved oxygen concentrations ≤ 2.5 ppm, then ~ 100 bubbles / min.
15.	Overlying water;	Laboratory reconstituted water
16.	Test chamber cleaning;	Only if necessary
17.	Overlying water quality;	D. O., pH and temperature daily; alkalinity, ammonia, conductivity, hardness & pH at beginning and end of test, conductivity @ 7, 14, 21 days
18.	Test duration;	28 days
19.	Effects measured;	Survival and growth as mean dry weight
20.	Test acceptability;	Minimum control survival 80 %

RESULTS

Effects on Survival / Control Sample

Raw data are presented at the end of this Appendix. Data were arcsine square root transformed. The data were found to be normally distributed, were tested for homogeneity of variances using Bartlett's test, and found to be homogeneous. It was therefore determined that parametric analyses were appropriate, and ANOVA followed by Dunnett's pairwise comparisons were used to determine differences between survival of organisms in station sediments and the control sample.

Results from the analysis, which compared survival in station sediments with survival of organisms exposed to the control sample, are presented in Table II and at the end of this Appendix.

Of the ten stations in the study area, station 4 caused 100% mortality and was eliminated from analysis. Sediment from stations 1, 2, 3, 5 and 8 did not produce mortality statistically different from the control exposure. Amphipods exposed to sediment from stations 6, 7, 9 and 10 had significantly less survival than those exposed to the control treatment, and were not included in weight determinations.

Table II. Percent survival of *H. azteca* by replicate chamber & survival comparison using control sample

	Station										
Replicate	Control	1	2	3	4*	5	6	7	8	9	10
A	100	100	100	90	0	100	100	70	100	60	90
B	90	90	100	80	0	100	70	40	100	80	60
C	100	90	100	90	0	80	60	70	90	100	80
D	100	100	90	70	0	100	60	60	80	70	60
E	100	100	80	90	0	80	60	40	90	70	50
Mean Survival	98.0	96.0	94.0	84.0	0	92.0	70.0	56.0	92.0	76.0	68.0
Statistically Different From Control	-	No	No	No	Yes	No	Yes	Yes	No	Yes	Yes

* Sample not included in ANOVA due to 100 % mortality

Effects on Growth / Control Sample

Raw data are presented at the end of this Appendix. The data were found to be normally distributed, were tested for homogeneity of variances using Bartlett's test, and found to be homogeneous. It was therefore determined that parametric analyses were appropriate, and ANOVA followed by Dumett's pairwise comparisons were used to determine differences between growth of organisms in station sediments and the control sample.

Results from the analysis, which compared mean dry weights for stations 1, 2, 3, 5 and 8 to the control sample, are presented in Table III and at the end of this Appendix.

Of the five stations that did not exhibit excessive mortality compared to the control sample, stations 1, 2, 3 and 5 did not produce mean dry weights significantly different from the control exposure. Only station 8 was found to be statistically significant for average dry weight.

Table III. Mean dry weight (mg.) of *H. azteca* by replicate chamber & growth comparison using control

Replicate	Station					
	Control	1	2	3	5	8
A	0.067	0.087	0.073	0.053	0.082	0.039
B	0.077	0.083	0.108	0.074	0.076	0.065
C	0.076	0.106	0.079	0.073	0.091	0.058
D	0.080	0.086	0.072	0.083	0.058	0.071
E	0.079	0.101	0.075	0.081	0.069	0.050
Mean Dry Wt. - mg.	0.076	0.093	0.081	0.073	0.075	0.057
Statistically Different From Control	-	No	No	No	No	Yes

REFERENCES

- [1] Ingersoll, C.G., G.A. Burton, T.D. Dawson, F.W. Dwyer, D.S. Ireland, R.A. Hoke, N.E. Kemble, D.R. Mount, T.J. Norberg-King, P.K. Sibley, and L. Stahl 2000 Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates EPA 600/R-99/064. U.S. Environmental Protection, Office of Science and Development, Duluth, MN
- [2] Toxstat March, 1994 Version 3.4 data analysis software published by West, Inc. Western EcoSystems Technology, Inc., Cheyenne, WY

RAW DATA FOR *Hyaella azteca* 28-DAY
SURVIVAL AND GROWTH TEST

Job Number: 173-01-01
 Species: H. azteca

Beginning Date & Time: 9-3-03 1720
 Ending Date & Time: 10-1-03 1000

Freshwater Sediment Test
 American Aquatic Testing, inc.,
 Observations/Live Count

		Day													
Conc.	Rep.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Control	A	B	B	B	B	B	B	B	N	N	B	N	N	N	N
	B	B	B	B	B	B	B	B	N	N	B	N	N	N	N
	C	B	B	B	N	B	B	B	N	N	B	N	N	N	N
	D	B	B	B	N	B	B	B	N	N	B	N	N	N	N
	E	B	B	B	N	B	B	B	N	N	B	N	N	N	N
Site 1	A	B	B	B	B	B	B	B	N	N	B	N	N	N	N
	B	B	B	B	B	B	B	B	N	N	B	N	N	N	N
	C	B	B	B	N	B	B	B	N	N	B	N	N	N	N
	D	B	B	B	N	B	B	B	N	N	B	N	N	N	N
	E	B	B	B	N	B	B	B	N	N	B	N	N	N	N
Site 2	A	B	B	B	B	B	B	B	N	N	B	N	N	N	N
	B	B	B	B	B	B	B	B	N	N	B	N	N	N	N
	C	B	B	B	B	B	B	B	N	N	B	N	N	N	N
	D	B	B	B	B	B	B	B	N	N	B	N	N	N	N
	E	B	B	B	B	B	B	B	N	N	B	N	N	N	N
Site 3	A	B	B	B	B	B	B	B	N	N	B	N	N	N	N
	B	B	B	B	B	B	B	B	N	N	B	N	N	N	N
	C	B	B	B	B	B	B	B	N	N	B	N	N	N	N
	D	B	B	B	B	B	B	B	N	N	B	N	N	N	N
	E	B	B	B	B	B	B	B	N	N	B	N	N	N	N
Site 4	A	B	B	B	B	B	B	B	N	N	B	N	N	N	N
	B	B	B	N	B	B	B	B	N	N	B	N	N	N	N
	C	B	B	N	B	B	B	B	N	N	B	N	N	N	N
	D	B	B	B	B	B	B	B	N	N	B	N	N	N	N
	E	B	B	B	B	B	B	B	N	N	B	N	N	N	N
Initials		TRP	TRP	JF	S	JF	MP	TRP	MP	TRP	MP	TRP	TRP	MP	TRP
Date		9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations

Comments:

Job Number: 173-01-01
 Species: H. azteca

Beginning Date & Time: 9-3-03 1720
 Ending Date & Time: 10-1-03 000

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

Day 28																	
Final Count																	
Conc.	Rep.	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Observ	Final Count
Control	A	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	10
	B	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	9
	C	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	10
	D	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	10
	E	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	10
Site 1	A	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	10
	B	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	9
	C	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	9
	D	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	10
	E	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	10
Site 2	A	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	10
	B	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	10
	C	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	10
	D	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	9
	E	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	8
Site 3	A	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	9
	B	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	8
	C	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	10
	D	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	7
	E	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	9
Site 4	A	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	0
	B	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	0
	C	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	0
	D	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	0
	E	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	0
Initials		TOP	TOP	TOP	MO	JS	TOP	TOP	TOP	JS	JS	JS	JS	TOP	JS	TOP	TOP
Date		9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/1

Key: D=dead, N=normal activity, A=abnormal activity B=no observations

Comments: ① 9-TOP 10/2

Job Number: 173-01-01
 Species: H. azteca

Beginning Date & Time: 9-3-03 1720
 Ending Date & Time: 10-1-03 1000

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

		Day													
Conc.	Rep.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Site 5	A	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	B	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	C	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	D	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	E	B	B	B	B	B	B	N	N	N	B	N	N	N	N
Site 6	A	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	B	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	C	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	D	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	E	B	B	B	B	B	B	N	N	N	B	N	N	N	N
Site 7	A	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	B	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	C	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	D	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	E	B	B	B	B	B	B	N	N	N	B	N	N	N	N
Site 8	A	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	B	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	C	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	D	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	E	B	B	B	B	B	B	N	N	N	B	N	N	N	N
Site 9	A	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	B	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	C	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	D	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	E	B	B	B	B	B	B	N	N	N	B	N	N	N	N
Initials		TAP	TAP	JF	JP	JF	MP	TAP	MP	TAP	MP	TAP	TAP	MP	TAP
Date		9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations

Comments: ① removed one worm 9/5 no

Job Number: 173-01-01
 Species: H. azteca

Beginning Date & Time: 9-3-03 1720
 Ending Date & Time: 10-1-03 1000

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

Observations/Live Count																	Day 28	
Day																	Observe	Final Count
Conc.	Rep.	14	15	16	17	18	19	20	21	22	23	24	25	26	27			
Site 5	A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	
	B	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	
	C	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	8	
	D	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	
	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	8	
Site 6 ^①	A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	
	B	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	7	
	C	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	6	
	D	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	6	
	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	6	
Site 7	A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	7	
	B	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	4	
	C	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	7	
	D	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	6	
	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	4	
Site 8	A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	
	B	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	9 ^①	
	C	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	9	
	D	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	9	
	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	9	
Site 9	A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	6	
	B	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	8	
	C	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	10	
	D	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	7	
	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	7	
Initials		TOP	TOP	TOP	TOP	TOP	TOP	TOP	TOP	TOP	TOP	TOP	TOP	TOP	TOP	TOP	TOP	
Date		9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/1	

Key: D=dead, N=normal activity, A=abnormal activity B=no observations

Comments: ① ALGAE PRESENT 9/20/03 JG - 6E ② 10 - TOP 10/1

Job Number: 173-01-01
 Species: H. azteca

Beginning Date & Time: 9-3-03 1720
 Ending Date & Time: 10-1-03 1000

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

		Day													
Conc.	Rep.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Site 10	A	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	B	B	B	B	B	B	B	N	N	N	B	N	N	N	N
	C	B	B	N	B	B	B	N	N	N	B	N	N	N	N
	D	B	B	B	B	B	10	N	N	N	B	N	N	N	N
	E	B	B	N	B	B	B	N	N	N	B	N	N	N	N
/	A														
	B														
	C														
	D														
	E														
/	A														
	B														
	C														
	D														
	E														
/	A														
	B														
	C														
	D														
	E														
/	A														
	B														
	C														
	D														
	E														
initials		TAP	TAP	JF	C	JF	MP	TAP	MP	TAP	MP	TAP	TAP	MP	TAP
Date		9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations

Comments:

Job Number: 173-01-01
 Species: H. aztec

Beginning Date & Time: 9-3-03 1720
 Ending Date & Time: 10-1-03 1000

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

Observations/Live Count																Day 28		
		Day														Observ	Final Count	
Conc.	Rep.	14	15	16	17	18	19	20	21	22	23	24	25	26	27			
Site 10	A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	9
	B	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	6
	C	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	8
	D	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	6
	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	5
/	A																	
	B																	
	C																	
	D																	
	E																	
/	A																	
	B																	
	C																	
	D																	
	E																	
/	A																	
	B																	
	C																	
	D																	
	E																	
/	A																	
	B																	
	C																	
	D																	
	E																	
Initials		TOP	TOP	TOP	TOP	JN	TOP	TOP	TOP	NP	NP	NP	NP	TOP	NP	TOP	TOP	
Date		9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/1	

Key: D=dead, N=normal activity, A=abnormal activity B=no observations

Comments:

Client/Toxicant: 173
 Project Number: 01-01
 Species: H. azteca

Beginning Date & Time: 9-3-03 1720
 Ending Date & Time: 10-1-03 1000
 Hatch Date: _____

American Aquatic Testing, Inc.

Weight Data

Cone.	Rep	Pan #	A weight of boat (g)	B weight of boat & org. (g)	(B-A)*1000=C dry weight of organisms (mg)	D # of surviving org.	C/D mean dry weight (mg)	C/E IC ₂₅ & NOEC calc. weight (mg)
Control	A	1	0.00485	0.00552	0.067 (1)	10	0.067	0.067
	B	2	0.00513	0.00582	0.069	9	0.077	0.069
	C	3	0.00403	0.00479	0.76	10	0.076	0.076
	D	4	0.00429	0.00509	0.80	10	0.080	0.080
	E	5	0.00456	0.00535	0.79	10	0.079	0.079
	F							
	G							
Site 1	A	6	0.00433	0.00520	0.87	10	0.087	0.087
	B	7	0.00448	0.00523	0.75	9	0.083	0.075
	C	8	0.00475	0.00570	0.95	9	0.106	0.095
	D	9	0.00453	0.00539	0.86	10	0.086	0.086
	E	10	0.00377	0.00478	1.01	10	0.101	0.101
	F							
	G							
Site 2	A	11	0.00454	0.00527	0.73	10	0.073	0.073
	B	12	0.00461	0.00569	1.08	10	0.108	0.108
	C	13	0.00481	0.00580	0.79	10	0.079	0.079
	D	14	0.00405	0.00470	0.65	9	0.072	0.065
	E	15	0.00437	0.00497	0.60	8	0.075	0.060
	F							
	G							
Site 3	A	16	0.00457	0.00505	0.48	9	0.053	0.048
	B	17	0.00466	0.00525	0.59	8	0.074	0.059
	C	18	0.00435	0.00501	0.66	9	0.073	0.066
	D	19	0.00470	0.00528	0.58	7	0.083	0.058
	E	20	0.00394	0.00467	0.73	9	0.081	0.073
	F							
	G							
Initials			JF	JF	JF	TP	JF	JF
Date			10/01	10/8	10/8	10/2	10/8	10/8

E = Original number of organisms at test initiation, adjusted for losses.

Observations: (1) 0.67 JF 10/8

Client/Toxicant: 173
 Project Number: 01-01
 Species: H. azteca

Beginning Date & Time: 9-3-03 1720
 Ending Date & Time: 10-1-03 1000
 Hatch Date: _____

American Aquatic Testing, Inc.

Weight Data

Cone.	Rep	Pan #	A weight of boat (g)	B weight of boat & org. (g)	(B-A)*1000=C dry weight of organisms (mg)	D # of surviving org.	C/D mean dry weight (mg)	C/E IC ₂₅ & NOEC calc. weight (mg)
Site 4	A	—	—	—	—	0	—	—
	B	—	—	—	—	0	—	—
	C	—	—	—	—	0	—	—
	D	—	—	—	—	0	—	—
	E	—	—	—	—	0	—	—
	F	—	—	—	—	—	—	—
	G	—	—	—	—	—	—	—
	H	—	—	—	—	—	—	—
Site 5	A	21	0.00503	0.00585	0.82	10	0.082	0.082
	B	22	0.00484	0.00530	0.76	10	0.076	0.076
	C	23	0.00446	0.00519	0.73	8	0.091	0.073
	D	24	0.00407	0.00465	0.58	10	0.058	0.058
	E	25	0.00511	0.00506	0.55	8	0.069	0.055
	F							
	G							
	H							
Site 6	A	26	0.00399	0.00451	0.52	10	0.052	0.052
	B	27	0.00501	0.00529	0.28	7	0.040	0.028
	C	28	0.00393	0.00438	0.45	6	0.075	0.045
	D	29	0.00382	0.00413	0.31	6	0.052	0.031
	E	30	0.00404	0.00434	0.30	6	0.050	0.030
	F	31						
	G							
	H							
Site 7	A	31	0.00454	0.00484	0.30	7	0.043	0.030
	B	32	0.00364	0.00383	0.19	4	0.048	0.019
	C	33	0.00444	0.00490	0.46	7	0.066	0.046
	D	34	0.00468	0.00504	0.36	6	0.060	0.036
	E	35	0.00438	0.00467	0.29	4	0.073	0.029
	F							
	G							
	H							
Initials			JF	JF	JF	DP	JF	JF
Date			10/01	10/8	10/8	10/2	10/8	10/8

E = Original number of organisms at test initiation, adjusted for losses.

Observations:

Client/Toxicant: 173
 Project Number: 01-01
 Species: 14 azteca

Beginning Date & Time: 9-3-03 1720
 Ending Date & Time: 10-1-03 1000
 Hatch Date: _____

American Aquatic Testing, Inc.

Weight Data

Cone.	Rep	Pan #	A weight of boat (g)	B weight of boat & org. (g)	(B-A)*1000=C dry weight of organisms (mg)	D # of surviving org.	C/D mean dry weight (mg)	C/E IC ₂₅ & NOEC calc. weight (mg)
Site 8	A	36	0.00421	0.00443	0.39	10	0.039	0.039
	B	37	0.00421	0.00486	0.65	10	0.065	0.065
	C	38	0.00462	0.00514	0.52	9	0.058	0.052
	D	39	0.00482	0.00539	0.57	8	0.071	0.057
	E	40	0.00510	0.00555	0.45	9	0.050	0.045
	F							
	G							
	H							
Site 9	A	41	0.00369	0.00414	0.45	6	0.075	0.045
	B	42	0.00489	0.00552	0.63	8	0.079	0.063
	C	43	0.00437	0.00499	0.62	10	0.062	0.062
	D	44	0.00480	0.00519	0.39	7	0.056	0.039
	E	45	0.00472	0.00501	0.29	7	0.041	0.029
	F							
	G							
	H							
Site 10	A	46	0.00461	0.00508	0.47	9	0.052	0.047
	B	47	0.00461	0.00489	0.28	6	0.047	0.028
	C	48	0.00410	0.00447	0.37	8	0.046	0.037
	D	49	0.00424	0.00455	0.31	6	0.052	0.031
	E	50	0.00367	0.00410	0.43	5	0.086	0.043
	F							
	G							
	H							
	A							
	B							
	C							
	D							
	E							
	F							
	G							
	H							
Initials			JF	JF	JF	TAP	JF	JF
Date			10/01	10/8	10/8	10/2	10/8	10/8

E = Original number of organisms at test initiation, adjusted for losses.

Observations: ① 0.00404 10/01 JF

Client/Toxicant: 173
 Project Number: 01-01
 Species: Hazleca

Beginning Date & Time: 9-3-03
 Ending Date & Time: _____
 Hatch Date: _____

American Aquatic Testing, Inc.
Weight Data

Cone.	Rep	Pan #	A weight of boat (g)	B weight of boat & org. (g)	(B-A)*1000=C dry weight of organisms (mg)	D # of surviving org.	C/D mean dry weight (mg)	C/E IC ₂₅ & NOEC calc. weight (mg)
Pre- Weights	A	1	0.00412	0.00433	0.21	10	0.021	
	B	2	0.00439	0.00457	0.18	10	0.018	
	C	3	0.00397	0.00415	0.18	10	0.018	
	D	4	0.00411	0.00431	0.20	10	0.020	
	E	5	0.00443	0.00462	0.19	10	0.019	
	F							
	G							
	H							
	A							
	B							
	C							
	D							
	E							
	F							
	G							
	H							
	A							
	B							
	C							
	D							
	E							
	F							
	G							
	H							
	A							
	B							
	C							
	D							
	E							
	F							
	G							
	H							
Initials			TAP	TAP	TAP	TAP	TAP	
Date			9/3	9/4	9/4	9/3	9/4	

E = Original number of organisms at test initiation, adjusted for losses.

Observations:

Job Number: 173-01-01
Species: H. azteca

Start Date & Time: 9-3-03 1720
End Date & Time: 10-1-03 1000

Sediment Test
American Aquatic Testing, Inc.,
Water Change Log/initial Water Readings/General Testing Information

Test Day	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Morning change(time)	0930	0950	1020	0930	0900	0930	0910	0800	0745	0830	0700	1000	0730	0800	0745
D.O. mg/L	7.6	7.5	8.0	7.7	8.5	7.2	8.4	8.6	8.7	8.6	8.4	8.2	8.2	8.6	8.5
pH	7.4	8.0	7.9	7.9	8.3	7.8	8.2	8.2	8.2	8.4	8.1	8.0	8.1	8.1	8.2
Temp. (C)	24.0	24.0	24.0	23.0	22.5	23.0	22.0	22.5	22.5	23.0	23.0	22.5	22.5	22.5	22.5
Initials	MP	MP	MP	MP	JF	MP	MP	JF	JF	JF	MP	MP	JF	JF	JF
Date	9/3	9/4	9/5	09/06	09/07	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/16
Afternoon change(time)	1725	1730	1700	1850	1630	1630	1610	1610	1610	1700	1730	1730	1800	1710	1800
D.O. mg/L	7.6	7.6	8.3	8.5	8.7	7.9	8.4	8.2	8.2	8.5	8.2	8.1	8.1	8.0	8.4
pH	7.6	7.9	7.6	8.3	8.3	7.8	7.6	7.6	7.6	8.1	7.9	7.9	7.7	7.9	8.0
Temp. (C)	23.5	22.5	22.0	22.0	22.0	23.5	22.0	22.5	22.5	22.5	22.5	23.5	22.0	23.5	23.0
Initials	MP	MP	JF	JF	JF	MP	MP	MP	MP	JF	MP	MP	MP	MP	MP
Date	9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17

Test Day	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Morning change(time)	0730	0900	0900	0900	0745	0930	1030	0800	0830	0630	1000	1000	0800	0900
D.O. mg/L	8.2	8.6	8.3	8.2	7.7	8.0	8.0	8.8	8.8	8.8	8.8	8.4	8.3	
pH	8.2	8.2	8.1	7.9	8.0	7.9	7.9	7.6	7.6	7.6	7.7	7.4	8.1	
Temp. (C)	22.5	22.0	22.5	23.0	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	
Initials	JF	JF	MP	JF	JF	MP	MP	JF	JF	MP	MP	MP	JF	
Date	9/18	9/19	09/20	09/21	9/22	09/23	09/24	9/25	9/26	9/27	9/28	9/29	9/30	
Afternoon change(time)	1700	1600	1730	1930	1700	2200	1630	1730	1800	2000	1600	1730	1800	
D.O. mg/L	8.2	8.9	8.2	8.1	7.9	7.9	7.7	8.3	8.7	8.7	8.8	8.5	7.8	
pH	7.8	7.7	7.9	7.8	8.0	7.9	7.7	7.9	7.7	7.6	7.7	7.6	7.8	
Temp. (C)	23.0	22.0	23.0	22.0	22.0	22.0	24.0	22.0	22.0	22.0	22.0	22.0	22.0	
Initials	MP	MP	JF	JF	MP	MP	MP	MP	MP	JF	MP	MP	MP	
Date	9/18	9/19	09/20	09/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1

Control Sed. collection date/by: 8-26-03/MP

Organism source: ABS Inc.

Test Chamber size: 300 ml

Control Sed. sieve date/by: 8-26-03/MP

Test organism Lot number: 639

Test Volume of sediment: 100 ml

Sieve size used: 18

Number of animals per chamber: 10

Test Volume of water: 175 ml

Sample sieve date/by: N/A

Food Type: YCT

Test Duration: 28 days

Sieve size used: N/A

Frequency of feeding: 1 x a day

Test Temperature Range: 23 ± 1°C

Client/Toxicant: 173
 Job Number: 01-01
 Species: H. azteca

Beginning Date & Time: 8-3-03 1720
 Ending Date & Time: 10-1-03 1000

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Physical / Chemical Parameters

Parameter	Concentration	Day											
		0	1	2	3	4	5	6	7	8	9	10	
TEMP (C)	Control	22.5	22.0	22.5	22.0	22.0	22.5	22.0	22.5	22.0	22.0	22.0	
	Site 1	22.5	22.0	22.5	22.0	22.0	22.5	22.0	22.5	22.0	22.0	22.0	
	Site 2	22.5	22.0	22.5	22.0	22.0	22.0	22.0	22.5	22.0	22.0	22.0	
	Site 3	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	
	Site 4	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	
	Site 5	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	
	Site 6	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	
	Site 7	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	
	Site 8	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	
	Site 9	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	
	Site 10	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	
Dissolved Oxygen (mg/L)	Control	5.9	6.3	7.5	7.2	6.8	6.4	6.9	6.8	6.7	7.2	6.6	
	Site 1	6.8	6.5	7.8	7.7	7.3	6.7	7.3	7.1	7.3	7.5	7.2	
	Site 2	6.7	6.7	7.8	7.4	7.3	6.7	7.4	7.2	7.2	7.5	7.1	
	Site 3	5.1	6.2	7.2	6.6	6.7	6.2	6.4	6.1	6.0	6.0	5.5	
	Site 4	5.2	6.1	7.1	6.6	7.2	6.5	7.0	6.9	7.0	7.4	7.0	
	Site 5	5.3	6.0	7.2	6.7	7.2	6.7	6.8	6.7	6.6	7.2	7.0	
	Site 6	5.8	6.2	7.3	7.3	7.2	6.5	6.8	7.1	6.8	7.2	6.9	
	Site 7	5.1	6.2	7.2	7.1	7.4	6.5	7.0	7.1	6.9	7.2	6.9	
	Site 8	5.1	6.5	7.3	7.0	7.3	6.5	7.0	7.0	6.9	7.3	7.0	
	Site 9	5.0	6.3	7.3	7.0	7.3	6.5	7.1	7.0	6.9	7.5	7.1	
	Site 10	5.0	6.2	7.2	7.3	7.5	6.5	7.1	7.0	6.7	7.6	7.2	
pH	Control	7.6	6.5	7.5	7.7	7.8	7.3	7.6	7.8	7.8	8.0	7.9	
	Site 1	7.5	6.7	7.6	7.7	7.8	7.4	7.6	7.8	7.8	7.8	7.8	
	Site 2	7.4	6.9	7.6	7.7	7.9	7.4	7.5	7.7	7.8	7.8	7.8	
	Site 3	7.4	6.9	7.6	7.7	7.8	7.4	7.4	7.6	7.8	7.7	7.6	
	Site 4	7.3	7.0	7.6	7.6	7.8	7.4	7.4	7.6	7.8	7.8	7.7	
	Site 5	7.2	7.0	7.6	7.6	7.8	7.4	7.4	7.6	7.7	7.8	7.7	
	Site 6	7.2	7.1	7.7	7.7	7.8	7.4	7.5	7.7	7.7	7.8	7.7	
	Site 7	7.2	7.2	7.7	7.7	7.8	7.4	7.5	7.7	7.8	7.8	7.8	
	Site 8	7.2	7.2	7.7	7.7	7.9	7.5	7.5	7.7	7.8	7.8	7.8	
	Site 9	7.2	7.2	7.7	7.7	7.9	7.5	7.5	7.8	7.8	7.8	7.8	
	Site 10	7.1	7.2	7.7	7.7	7.9	7.5	7.5	7.7	7.7	7.8	7.9	
Initials		MD	MD	MD	JF	JF	MD	MD	MD	MD	MD	MD	
Date		9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	

Concentration	Cond. (umhos)		Alkalinity (mg/L)		Hardness (mg/L)		Ammonia (mg/L)		Comments: @ Day 7
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
Control	275	280	60	80	80	120	0.04	0.00	
Site 1	275	270	70	70	70	100	0.00	0.02	
Site 2	275	275	70	70	80	100	0.00	0.01	
Site 3	275	275	60	70	80	100	0.10	0.00	
Site 4	275	275	60	60	80	90	0.00	0.00	
Site 5	280	275	70	60	70	90	0.13	0.01	
Site 6	270	270	60	60	70	90	0.13	0.03	
Site 7	280	275	70	70	80	100	0.16	0.01	
Site 8	280	270	70	70	80	100	0.15	0.02	
Site 9	280	275	70	80	80	110	0.23	0.02	
Site 10	270	275	50	60	80	100	0.09	0.02	
Initials	MD	MD	MD	MD	MD	MD	MD	MD	
Date	9/3	9/10	9/3	10/1	9/3	10/1	9/3	10/1	

Client/Toxicant: 173
 Job Number: 01-01
 Species: H. azteca

Beginning Date & Time: 9-3-03 1720
 Ending Date & Time: 10-1-03 1000

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Physical / Chemical Parameters

Parameter	Concentration	Day										
		11	12	13	14	15	16	17	18	19	20	21
TEMP (C)	Control	23.0	22.0	22.0	22.0	22.5	22.0	23.0	22.5	23.0	22.0	23.0
	Site 1	23.0	22.0	22.0	22.0	22.5	22.0	23.0	22.5	23.0	22.0	23.0
	Site 2	23.0	22.0	22.0	22.0	22.5	22.0	23.0	22.5	23.0	22.0	23.0
	Site 3	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.5	23.0	22.0	23.0
	Site 4	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.5	23.0	22.0	23.0
	Site 5	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.5	23.0	22.0	23.0
	Site 6	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.5	23.0	22.0	23.0
	Site 7	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.5	23.0	22.0	23.0
	Site 8	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.5	23.0	22.0	23.0
	Site 9	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.5	23.0	22.0	23.0
	Site 10	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.0	23.0	22.0	23.0
Dissolved Oxygen (mg/L)	Control	6.8	6.6	6.7	6.9	6.8	6.7	6.6	6.1	6.3	6.4	6.6
	Site 1	7.3	7.0	6.7	7.0	7.0	7.3	7.0	6.7	6.5	6.3	6.4
	Site 2	7.1	7.0	7.0	7.2	7.1	7.4	7.1	6.8	6.7	6.6	6.5
	Site 3	5.7	6.1	5.7	5.9	5.8	5.9	5.4	5.5	5.2	5.2	5.8
	Site 4	7.1	7.0	6.8	6.8	6.8	7.1	6.9	6.3	6.8	5.8	5.9
	Site 5	7.1	6.9	6.6	6.9	6.8	6.1	6.6	6.0	6.4	6.5	6.7
	Site 6	7.0	6.8	6.4	6.7	6.9	6.6	6.5	6.3	6.3	6.7	7.0
	Site 7	7.0	6.9	6.5	6.8	6.9	6.9	7.0	6.5	6.2	6.9	7.1
	Site 8	7.0	6.8	6.6	6.7	6.8	7.0	7.1	6.1	6.0	6.5	7.0
	Site 9	7.0	6.9	6.9	7.0	7.0	7.0	7.0	6.3	6.1	6.5	6.9
	Site 10	7.1	6.8	6.4	6.9	6.8	7.3	7.1	6.9	6.4	6.4	6.8
pH	Control	7.9	7.4	7.5	7.6	7.7	8.1	7.8	7.6	7.7	8.1	7.9
	Site 1	7.8	7.4	7.5	7.6	7.7	7.9	7.8	7.6	7.7	8.0	7.8
	Site 2	7.8	7.4	7.5	7.6	7.8	7.8	7.8	7.6	7.6	7.8	7.8
	Site 3	7.7	7.5	7.4	7.5	7.6	7.7	7.6	7.6	7.4	7.8	7.8
	Site 4	7.8	7.4	7.4	7.5	7.8	7.7	7.7	7.6	7.6	7.8	7.8
	Site 5	7.8	7.5	7.8	7.6	7.8	7.9	7.8	7.7	7.6	7.8	7.8
	Site 6	7.8	7.5	7.8	7.7	7.8	8.0	7.9	7.8	7.8	7.9	7.8
	Site 7	7.8	7.5	7.8	7.7	7.8	8.0	7.9	7.9	7.9	7.9	7.8
	Site 8	7.8	7.6	7.8	7.7	7.8	7.9	7.9	7.9	7.9	7.8	7.8
	Site 9	7.9	7.6	7.7	7.8	7.8	7.9	7.8	7.8	7.9	7.8	7.9
	Site 10	7.9	7.5	7.6	7.7	7.8	7.8	7.8	7.8	7.7	7.7	7.8
Initials		MP	MP	MP	MP	MP	MP	MP	MP	MP	MP	MP
Date		9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24

Concentration	Cond. (umhos)		Alkalinity (mg/L)		Hardness (mg/L)		Ammonia (mg/L)		Comments: ① Day 14 ② Day 21
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
Control	280	290							
Site 1	275	280							
Site 2	280	275							
Site 3	280	285							
Site 4	280	285							
Site 5	270	280							
Site 6	270	285							
Site 7	275	280							
Site 8	280	280							
Site 9	275	285							
Site 10	280	285							
Initials	MP	MP							
Date	9/17	9/24							

Client/Toxicant: 173
 Job Number: 01-01
 Species: H. azteca

Beginning Date & Time: 9-3-03 1720
 Ending Date & Time: 10-1-03 1000

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Physical / Chemical Parameters

Parameter	Concentration	Day										
		22	23	24	25	26	27	28	29	30	31	32
TEMP (C)	Control	22.0	23.0	22.0	22.0	23.0	23.0	22.0				
	Site 1	22.0	23.0	22.0	22.0	23.0	23.0	22.0				
	Site 2	22.0	22.5	22.0	22.0	23.0	23.0	22.0				
	Site 3	22.0	22.5	22.0	22.0	23.0	23.0	22.0				
	Site 4	22.0	22.5	22.0	22.0	23.0	23.0	22.0				
	Site 5	22.0	22.5	22.0	22.0	23.0	23.0	22.0				
	Site 6	22.0	22.5	22.0	22.0	23.0	23.0	22.0				
	Site 7	22.0	22.5	22.0	22.0	23.0	23.0	22.0				
	Site 8	22.0	22.5	22.0	22.0	23.0	23.0	22.0				
	Site 9	22.0	22.5	22.0	22.0	23.0	23.0	22.0				
	Site 10	22.0	22.0	22.0	22.0	23.0	23.0	22.0				
Dissolved Oxygen (mg/L)	Control	8.0	5.5	5.7	5.9	6.3	5.5	6.0				
	Site 1	7.0	6.4	6.3	5.9	6.0	6.0	6.7				
	Site 2	6.9	6.4	6.3	6.2	6.5	6.4	6.6				
	Site 3	5.6	5.2	5.0	5.6	5.2	5.0	5.3				
	Site 4	6.4	6.2	6.1	6.0	6.3	6.2	6.6				
	Site 5	6.4	6.0	6.1	6.0	6.2	6.0	6.1				
	Site 6	6.5	6.0	6.1	6.0	6.2	6.1	6.2				
	Site 7	6.5	6.0	5.9	6.0	6.4	6.3	6.3				
	Site 8	6.5	6.0	5.9	6.1	6.2	6.0	6.2				
	Site 9	6.5	6.0	6.0	6.2	6.4	6.1	6.4				
	Site 10	6.9	6.2	6.1	6.2	6.5	6.3	6.7				
pH	Control	8.0	8.5	8.4	8.5	8.3	8.4	7.63	8.1			
	Site 1	8.0	8.3	8.3	8.4	8.2	8.1	7.5	7.9			
	Site 2	7.9	8.1	8.1	8.2	8.1	8.1	7.5	7.8			
	Site 3	7.6	8.0	8.1	8.2	8.0	7.8	7.4	7.7			
	Site 4	7.6	7.9	8.0	7.9	8.1	7.8	7.4	7.7			
	Site 5	7.5	7.8	7.8	7.9	8.1	7.7	7.4	7.6			
	Site 6	7.6	7.9	7.8	7.9	8.1	7.8	7.4	7.6			
	Site 7	7.8	7.9	7.8	8.0	8.1	7.8	7.5	7.7			
	Site 8	7.8	8.1	8.0	8.0	8.1	7.9	7.5	7.7			
	Site 9	7.8	8.1	7.9	7.8	8.1	7.8	7.5	7.7			
	Site 10	7.9	7.9	7.8	7.8	8.0	7.8	7.5	7.7			
Initials		MP	JF	MP	MP	MP	MP	ER/CN	MP			
Date		9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/1			

Concentration	Cond. (umhos)		Alkalinity (mg/L)		Hardness (mg/L)		Ammonia (mg/L)		Comments:
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
Control	350								① 7.0 MP 9/25 ② Conductivity on day 28 ③ pH REDONE METER NOT CALIBRATED PROB/C
Site 1	320								
Site 2	320								
Site 3	320								
Site 4	310								
Site 5	310								
Site 6	315								
Site 7	325								
Site 8	325								
Site 9	325								
Site 10	310								
Initials	ER/CN								
Date	10/1								

STATISTICAL DATA FOR *Hyaella azteca* 28-DAY
SURVIVAL
USING CONTROL SEDIMENT

Matteo Metals H. azteca 28d surv. date 09/03/03

File: d:\toxstat\1730101h.asu

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	5	1.249	1.412	1.379
2	SITE 1	5	1.249	1.412	1.347
3	SITE 2	5	1.107	1.412	1.318
4	SITE 3	5	0.991	1.249	1.169
5	SITE 5	5	1.107	1.412	1.290
6	SITE 6	5	0.886	1.412	1.012
7	SITE 7	5	0.685	0.991	0.848
8	SITE 8	5	1.107	1.412	1.286
9	SITE 9	5	0.886	1.412	1.078
10	SITE 10	5	0.785	1.249	0.983

Matteo Metals H. azteca 28d surv. date 09/03/03

File: d:\toxstat\1730101h.asu

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	0.005	0.073	0.033	5.28
2	SITE 1	0.008	0.089	0.040	6.63
3	SITE 2	0.019	0.138	0.062	10.44
4	SITE 3	0.014	0.117	0.052	10.00
5	SITE 5	0.028	0.167	0.075	12.94
6	SITE 6	0.052	0.228	0.102	22.53
7	SITE 7	0.024	0.155	0.069	18.26
8	SITE 8	0.017	0.129	0.058	10.03
9	SITE 9	0.041	0.203	0.091	18.81
10	SITE 10	0.036	0.190	0.085	19.31

Matteo Metals H. azteca 28d surv. date 09/03/03

File: d:\toxstat\1730101h.asu Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.974

W = 0.935

Critical W (P = 0.05) (n = 50) = 0.947

Critical W (P = 0.01) (n = 50) = 0.930

Data PASS normality test at P=0.01 level. Continue analysis.

Matteo Metals H. azteca 28d surv. date 09/03/03

File: d:\toxstat\1730101h.asu Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 7.53

Table Chi-square value = 21.67 (alpha = 0.01, df = 9)

Table Chi-square value = 16.92 (alpha = 0.05, df = 9)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Matteo Metals H. azteca 28d surv. date 09/03/03

File: d:\toxstat\1730101h.asu

Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	9	1.487	0.165	6.789
Within (Error)	40	0.974	0.024	
Total	49	2.461		

Critical F value = 2.12 (0.05,9,40)

Since F > Critical F REJECT Ho: All equal

Matteo Metals H. azteca 28d surv. date 09/03/03

File: d:\toxstat\1730101h.asu

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST - TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	1.379	0.980		
2	SITE 1	1.347	0.960	0.330	
3	SITE 2	1.318	0.940	0.618	
4	SITE 3	1.169	0.840	2.132	
5	SITE 5	1.290	0.920	0.906	
6	SITE 6	1.012	0.700	3.721	*
7	SITE 7	0.848	0.560	5.390	*
8	SITE 8	1.286	0.920	0.948	
9	SITE 9	1.078	0.760	3.060	*
10	SITE 10	0.983	0.680	4.020	*

Dunnett table value = 2.51 (1 Tailed Value, P=0.05, df=40,9)

Matteo Metals H. azteca 28d surv. date 09/03/03

File: d:\toxstat\1730101h.asu

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST - TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Control	5			
2	SITE 1	5	0.145	14.7	0.020
3	SITE 2	5	0.145	14.7	0.040
4	SITE 3	5	0.145	14.7	0.140
5	SITE 5	5	0.145	14.7	0.060
6	SITE 6	5	0.145	14.7	0.280
7	SITE 7	5	0.145	14.7	0.420
8	SITE 8	5	0.145	14.7	0.060
9	SITE 9	5	0.145	14.7	0.220
10	SITE 10	5	0.145	14.7	0.300

TITLE: Matteo Metals H. azteca 28d surv. date 09/03/03

FILE: d:\toxstat\1730101h.asu

TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 10

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	1.0000	1.4120
1	Control	2	0.9000	1.2490
1	Control	3	1.0000	1.4120
1	Control	4	1.0000	1.4120
1	Control	5	1.0000	1.4120
2	SITE 1	1	1.0000	1.4120
2	SITE 1	2	0.9000	1.2490
2	SITE 1	3	0.9000	1.2490
2	SITE 1	4	1.0000	1.4120
2	SITE 1	5	1.0000	1.4120
3	SITE 2	1	1.0000	1.4120
3	SITE 2	2	1.0000	1.4120
3	SITE 2	3	1.0000	1.4120
3	SITE 2	4	0.9000	1.2490
3	SITE 2	5	0.8000	1.1071
4	SITE 3	1	0.9000	1.2490
4	SITE 3	2	0.8000	1.1071
4	SITE 3	3	0.9000	1.2490
4	SITE 3	4	0.7000	0.9912
4	SITE 3	5	0.9000	1.2490
5	SITE 5	1	1.0000	1.4120
5	SITE 5	2	1.0000	1.4120
5	SITE 5	3	0.8000	1.1071
5	SITE 5	4	1.0000	1.4120
5	SITE 5	5	0.8000	1.1071
6	SITE 6	1	1.0000	1.4120
6	SITE 6	2	0.7000	0.9912
6	SITE 6	3	0.6000	0.8861
6	SITE 6	4	0.6000	0.8861
6	SITE 6	5	0.6000	0.8861
7	SITE 7	1	0.7000	0.9912
7	SITE 7	2	0.4000	0.6847
7	SITE 7	3	0.7000	0.9912
7	SITE 7	4	0.6000	0.8861
7	SITE 7	5	0.4000	0.6847
8	SITE 8	1	1.0000	1.4120
8	SITE 8	2	1.0000	1.4120
8	SITE 8	3	0.9000	1.2490
8	SITE 8	4	0.8000	1.1071
8	SITE 8	5	0.9000	1.2490
9	SITE 9	1	0.6000	0.8861
9	SITE 9	2	0.8000	1.1071
9	SITE 9	3	1.0000	1.4120
9	SITE 9	4	0.7000	0.9912
9	SITE 9	5	0.7000	0.9912
10	SITE 10	1	0.9000	1.2490
10	SITE 10	2	0.6000	0.8861
10	SITE 10	3	0.8000	1.1071
10	SITE 10	4	0.6000	0.8861
10	SITE 10	5	0.5000	0.7854

STATISTICAL DATA FOR *Hyaella azteca* 28-DAY
GROWTH
USING CONTROL SEDIMENT

Matteo Metals H. azteca 28d grow. date 09/03/03

File: D:\TOXSTAT\1730101H.AGR

Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	5	0.067	0.080	0.076
2	SITE 1	5	0.083	0.106	0.093
3	SITE 2	5	0.072	0.108	0.081
4	SITE 3	5	0.053	0.083	0.073
5	SITE 5	5	0.058	0.091	0.075
6	SITE 8	5	0.039	0.071	0.057

Matteo Metals H. azteca 28d grow. date 09/03/03

File: D:\TOXSTAT\1730101H.AGR

Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	0.000	0.005	0.002	6.82
2	SITE 1	0.000	0.010	0.005	11.03
3	SITE 2	0.000	0.015	0.007	18.56
4	SITE 3	0.000	0.012	0.005	16.32
5	SITE 5	0.000	0.013	0.006	16.70
6	SITE 8	0.000	0.013	0.006	22.23

Matteo Metals H. azteca 28d grow. date 09/03/03

File: D:\TOXSTAT\1730101H.AGR Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.003

W = 0.978

Critical W (P = 0.05) (n = 30) = 0.927

Critical W (P = 0.01) (n = 30) = 0.900

Data PASS normality test at P=0.01 level. Continue analysis.

Matteo Metals H. azteca 28d grow. date 09/03/03

File: D:\TOXSTAT\1730101H.AGR Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated Bl statistic = 3.80

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)

Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS Bl homogeneity test at 0.01 level. Continue analysis.

Matteo Metals H. azteca 28d grow. date 09/03/03

File: D:\TOXSTAT\1730101H.AGR

Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.003	0.001	5.082
Within (Error)	24	0.003	0.000	
Total	29	0.007		

Critical F value = 2.62 (0.05,5,24)

Since F > Critical F REJECT Ho: All equal

Matteo Metals H. azteca 28d grow. date 09/03/03

File: D:\TOXSTAT\1730101H.AGR

Transform: NO TRANSFORMATION

DUNNETT'S TEST

TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	0.076	0.076		
2	SITE 1	0.093	0.093	-2.277	
3	SITE 2	0.081	0.081	-0.759	
4	SITE 3	0.073	0.073	0.407	
5	SITE 5	0.075	0.075	0.081	
6	SITE 8	0.057	0.057	2.602	*

Dunnett table value = 2.36 (1 Tailed Value, P=0.05, df=24,5)

Matteo Metals H. azteca 28d grow. date 09/03/03

File: D:\TOXSTAT\1730101H.AGR

Transform: NO TRANSFORMATION

DUNNETT'S TEST

TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Control	5			
2	SITE 1	5	0.017	23.0	-0.017
3	SITE 2	5	0.017	23.0	-0.006
4	SITE 3	5	0.017	23.0	0.003
5	SITE 5	5	0.017	23.0	0.001
6	SITE 8	5	0.017	23.0	0.019

FILE: Matteo Metals H. azteca 28d grow. date 09/03/03

FILE: D:\TOXSTAT\1730101H.AGR

TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	0.0670	0.0670
1	Control	2	0.0770	0.0770
1	Control	3	0.0760	0.0760
1	Control	4	0.0800	0.0800
1	Control	5	0.0790	0.0790
2	SITE 1	1	0.0870	0.0870
2	SITE 1	2	0.0830	0.0830
2	SITE 1	3	0.1060	0.1060
2	SITE 1	4	0.0860	0.0860
2	SITE 1	5	0.1010	0.1010
3	SITE 2	1	0.0730	0.0730
3	SITE 2	2	0.1080	0.1080
3	SITE 2	3	0.0790	0.0790
3	SITE 2	4	0.0720	0.0720
3	SITE 2	5	0.0750	0.0750
4	SITE 3	1	0.0530	0.0530
4	SITE 3	2	0.0740	0.0740
4	SITE 3	3	0.0730	0.0730
4	SITE 3	4	0.0830	0.0830
4	SITE 3	5	0.0810	0.0810
5	SITE 5	1	0.0820	0.0820
5	SITE 5	2	0.0760	0.0760
5	SITE 5	3	0.0910	0.0910
5	SITE 5	4	0.0580	0.0580
5	SITE 5	5	0.0690	0.0690
6	SITE 8	1	0.0390	0.0390
6	SITE 8	2	0.0650	0.0650
6	SITE 8	3	0.0580	0.0580
6	SITE 8	4	0.0710	0.0710
6	SITE 8	5	0.0500	0.0500

CHAIN OF CUSTODY DOCUMENTATION



Severn Trent Laboratories, Inc.

208 South Park Drive, Suite 1, Colchester, VT 05446 Tel: (802) 655-1203

CHAIN OF CUSTODY RECORD

Report to: Company: <u>Louis Berger Group</u> Address: <u>30 Vreeland Road, Bldg A</u> <u>Florham Park, NJ 07932</u> Contact: <u>Tom Tunic</u> Phone: <u>973-678-1960 x608</u> Fax: <u>973-678-3564</u> Contract/ Quote:				Invoice to: Company: <u>Louis Berger Group</u> Address: <u>30 Vreeland Road, Bldg A</u> <u>Florham Park, NJ 07932</u> Contact: <u>Tom Tunic</u> Phone: <u>973-678-1960</u> Fax: <u>973-678-3564</u>				ANALYSIS REQUESTED <div style="border: 1px solid black; padding: 5px; transform: rotate(-90deg); transform-origin: center;"> Toxicity PCB Lead TOC, PH Grain Size </div>				<div style="border: 1px solid black; padding: 5px;"> Lab Use Only Due Date: Temp. of coolers when received (C): 1 2 3 4 Custody Seal N/Y Intact N/Y Screened For Radioactivity <input type="checkbox"/> </div>			
Sampler's Name <u>Brian Janikowski</u>				Sampler's Signature <u>Brian Janikowski</u>				JOB: N049							
Proj. No: <u>SV-1962</u>		Project Name <u>Matted Iron & Metal</u>		No/Type of Containers <u>24/1 L: 12/1602 A</u>											
Matrix	Date	Time	Comp	Gr	Identifying Marks of Sample(s)	VOA	A/G 1 Lt.	250 ml	P/O	Lab/Sample ID (Lab Use Only)					
S	8/14/03	1245		K	SED 6 03684 Soil	6				4	1	1	452971		
S	8/14/03	1320		K	SED 5 03633	6				4	1	1	452972		
S	8/14/03	1400		K	SED 4 03632	6				4	1	1	452973		
S	8/14/03	1430		X	SED 3 03631	6				4	1	1	452974		
S	8/14/03	1530		X	SED 2 03630	6				4	1	1	452975		
S	8/14/03	1600		X	SED 1 15N03629	6				4	1	1	452976		
<u>up</u> <u>8/19</u>															
<div style="display: flex; justify-content: space-between;"> <div> Relinquished by: (Signature) <u>Brian Janikowski</u> </div> <div> Date <u>8/19/03</u> </div> <div> Time <u>5:45</u> </div> <div> Received by: (Signature) <u>W. J. ...</u> </div> <div> Date <u>8-19-03</u> </div> <div> Time <u>0845</u> </div> <div> Remarks <u>Sediment samples</u> </div> </div>															
<div style="display: flex; justify-content: space-between;"> <div> Relinquished by: (Signature) <u>W. J. ...</u> </div> <div> Date <u>8-19-03</u> </div> <div> Time <u>1105</u> </div> <div> Received by: (Signature) <u>R. ...</u> </div> <div> Date <u>8/19/03</u> </div> <div> Time </div> </div>															
<div style="display: flex; justify-content: space-between;"> <div> Relinquished by: (Signature) <u>W. J. ...</u> </div> <div> Date <u>8-19</u> </div> <div> Time <u>1315</u> </div> <div> Received by: (Signature) <u>T. ...</u> </div> <div> Date </div> <div> Time </div> </div>															
<div style="display: flex; justify-content: space-between;"> <div> Matrix WW - Wastewater VOA - 40 ml vial </div> <div> W - Water A/G - Amber / Or Glass 1 Liter </div> <div> S - Soil L - Liquid 250 ml - Glass wide mouth </div> <div> A - Air bag C - Charcoal Tube P/O - Plastic or other </div> <div> SL - Sludge O - Oil </div> <div> STL cannot accept verbal changes. Please Fax written changes to (802) 655-1248 </div> </div>															

STL-8234 (07/00)

REC'D FOR AMERICAN AQUATIC Valley 08/24/03 1830 HOB

Severn Trent Laboratories, Inc.

208 South Park Drive, Suite 1, Colchester, VT 05446 Tel: (802) 555-1203

CHAIN OF CUSTODY RECORD

Report to: Company: <u>Louis Berger Group</u> Address: <u>30 Vreeland Rd. Bldg. A</u> <u>Florham Park, NJ 07932</u> Contact: <u>Tom Tanico</u> Phone: <u>973-678-1960 x608</u> Fax: <u>973-676-3564</u> Contract/ Quote:		Invoice to: Company: <u>Louis Berger Group</u> Address: <u>30 Vreeland Rd. Bldg. A</u> <u>Florham Park, NJ 07932</u> Contact: <u>Tom Tanico</u> Phone: <u>973-678-1960 x608</u> Fax: <u>973-676-3564</u>		ANALYSIS REQUESTED Toxicity PCBs Lead Ph. TOC Grain Size	Lab Use Only Due Date: Temp. of coolers when received (C): 1 2 3 4 5 Custody Seal N/Y Intact N/Y Screened For Radioactivity: <input type="checkbox"/>
---	--	---	--	--	---

Sampler's Name <u>Brian Sankauskas</u>	Sampler's Signature 	JOB: <u>N101</u>
---	-------------------------	------------------

Proj. No.		Project Name		No. Type of Containers								
JG-1962		Mated Iron & Metal		21 E 1, 10 A 1602								
Matrix	Date	Time	COED	G 7 8 b	Identifying Marks of Sample(s)	Matr'n	No. of	VOA	A/G	250	P/O	Lab/Sample ID (Lab Use Only)
S	8/16/03	1200	X		SED 10	Soil	10					453149 1STN
S	8/16/03	1225	X		SED 7		10					453150 1STN
S	8/16/03	1245	X		SED 9		6					453151 1STN
S	8/16/03	1315	X		SED 8		6					453152 1STN
S	8/16/03	-	X		SEDDUP	↓	1					453153

TOXICITY
RES. LAB
GRAIN

REC'D AMERICAN AQ.
J. Kelly 08/21/03
1830 HRS

Relinquished by: (Signature) 	Date <u>8/17/03</u>	Time <u>1600</u>	Received by: (Signature) 	Date <u>8/17/03</u>	Time <u>1600</u>	Remarks Provide USEPA EDP Sediment samples SEDDUP analyze for PCB and lead only Client's delivery of samples constitutes acceptance of Severn Trent Laboratories terms and conditions contained in the Price Schedule.
Relinquished by: (Signature) 	Date <u>8/19/03</u>	Time <u>1600</u>	Received by: (Signature) 	Date <u>8/19/03</u>	Time <u>1715</u>	
Relinquished by: (Signature) 	Date <u>8/19/03</u>	Time <u>1800</u>	Received by: (Signature) 	Date _____	Time _____	

WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil
 VOA - 40 ml/vial A/G - Amber / Or Glass 1 liter 250 ml - Glass wide mouth P/O - Plastic or other

STL cannot accept verbal changes.
Please Enclose

STL EDISON

NRB 649 761 VU 100 3878

148234 (0700)

**SEVERN
TRENT
SERVICES**

Severn Trent Laboratories, Inc.

208 South Park Drive, Suite 1, Colchester, VT 05446 Tel: (802) 655-1203

CHAIN OF CUSTODY RECORD

Report to: Company: <u>Louis Berger Group</u> Address: <u>30 Ureeland Rd. Bldg A</u> <u>Florham Park, NJ 07932</u> Contact: <u>Tom Tanico</u> Phone: <u>973-678-1960 x 608</u> Fax: <u>973-676-3564</u> Contract/ Quote: _____										Invoice to: Company: <u>Louis Berger Group</u> Address: <u>30 Ureeland Rd Bldg A</u> <u>Florham Park, NJ 07932</u> Contact: <u>Tom Tanico</u> Phone: <u>973-678-1960 x 608</u> Fax: <u>973-676-3564</u>										ANALYSIS REQUESTED <div style="border: 1px solid black; padding: 5px; height: 100px; position: relative;"> Toxicity </div>										Lab Use Only Due Date: _____ Temp. of coolers when received (C°): <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td> </tr> <tr> <td> </td><td> </td><td> </td><td> </td><td> </td> </tr> </table> Custody Seal: N / Y Intact: N / Y Screened For Radioactivity: <input type="checkbox"/>					1	2	3	4	5					
1	2	3	4	5																																								
Sampler's Name <u>Brian Janikawskas</u>										Sampler's Signature <u>Brian Janikawskas</u>																																		
Proj. No. <u>SG-1982</u>			Project Name <u>Matteo Iron & Metal</u>							No/Type of Containers <u>32/P 1 liter</u>																																		
Matrix	Date	Time	Comp	Grab	Identifying Marks of Sample(s)	VOA	A/G 1 Lt.	250 ml	P/O	Lab/Sample ID (Lab Use Only)																																		
S	8/20	1300		X	SED 1					4	<div style="font-size: 4em; transform: rotate(45deg); opacity: 0.5;">X</div>																																	
S	8/20	1230		X	SED 2					4											ISTN 03629																							
S	8/20	1210		X	SED 3					4											03630																							
S	8/20	1145		X	SED 4					4											03631																							
S	8/20	1120		X	SED 5					4											03632																							
S	8/20	1050		X	SED 6					4											03633 03634																							
S	8/20	1200		X	SED 8					4											03635																							
S	8/20	1220		X	SED 9					4											03636																							
																					03637																							
Relinquished by: (Signature) <u>[Signature]</u>										Date <u>8/21/03</u>		Time <u>8:30</u>		Received by: (Signature) <u>[Signature]</u>		Date <u>8-21-03</u>		Time <u>0840</u>		Remarks <u>provide US DEP EDD</u> Client's delivery of samples constitutes acceptance of Severn Trent Laboratories terms and conditions contained in the Price Schedule.																								
Relinquished by: (Signature) <u>[Signature]</u>										Date <u>8-21-03</u>		Time <u>12:00</u>		Received by: (Signature) <u>[Signature]</u>		Date <u>8-21-03</u>		Time <u>12:00</u>																										
Relinquished by: (Signature) <u>[Signature]</u>										Date <u>8-21-03</u>		Time <u>13:30</u>		Received by: (Signature) <u>[Signature]</u>		Date 		Time 																										
Matrix WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil Container VOA - 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth P/O - Plastic or other										STL cannot accept verbal changes. Please Fax written changes to (802) 655-1248																																		

1105 UNION BLVD.
ALLENTOWN, PA 18103
610 434 9015

Job #: 8RS

Client: AAT, Inc.
Address: _____
Phone #: _____

CHAIN OF CUSTODY

Client Contact: CHRIS NALLY

Sample Return to client ☒

Disposal: Lab disposal ☐

[illegible]

Samples were:

1. Collected by AAT personnel ☒ 2. Transported on ice? ☒ 3. Received within holding time? ☒ 4. Sample matrix is: Liquid ☐ Sediment ☒
Client personnel ☐ Yes ☒ No ☐ Yes ☒ No ☐ Soil ☐ Other ☐

CUSTODY INFORMATION

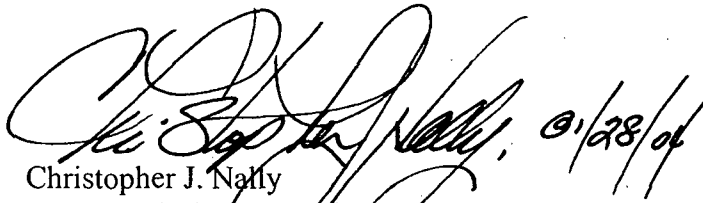
[illegible]


Appendix B

Sediment toxicity testing - *Chironomus tentans*

REPORT CERTIFICATION

The following report titled "THE LOUIS BERGER GROUP, INC. MATTEO IRON AND METALS SEDIMENT TOXICITY TESTING – *Chironomus tentans*" is an accurate and truthful representation of the toxicity testing which was performed by American Aquatic Testing, Inc., located at 1105 Union Blvd. Allentown, Pennsylvania. We further certify that we have personally examined and are familiar with the information submitted in this document and based on our inquiry of those individuals immediately responsible for obtaining the information, we believe the submitted information is complete as presented. We are aware that there are significant penalties for submitting false information.


Christopher J. Nally
President, Laboratory Director


Tarmo Pallop
Vice-President, Laboratory Manager

APPENDIX B

THE LOUIS BERGER GROUP, INC.
MATTEO IRON AND METALS
SEDIMENT TOXICITY TESTING – *Chironomus tentans*

Contents

<u>Section</u>	<u>Page</u>
Introduction	2
Materials and Methods; <i>Chironomus tentans</i>	2
Results	6

Tables

I.	Summary of Conditions for <i>Chironomus tentans</i> Toxicity Test	5
II.	Percent survival of <i>C. tentans</i> by replicate chamber and mean survival using control sample	6
III.	Mean dry weight (mg.) of <i>C. tentans</i> by replicate chamber and growth comparison using control	7

Data

Raw data for *Chironomus tentans* 20-day survival and growth test

Statistical data for *Chironomus tentans* 20-day survival using control sediment

Statistical data for *Chironomus tentans* 20-day growth test using control sediment

Chain of Custody Documentation

MATTEO IRON AND METALS SEDIMENT TOXICITY TESTING – *Chironomus tentans*

INTRODUCTION

During the month of August 2003, samples of sediment were collected from the Matteo Iron and Metals facility and surrounding area in Gloucester County, New Jersey. These sediment samples were used to perform toxicity tests to determine if the tested matrices represent a significant threat to potential receptor organisms.

The sediment samples from the study area were delivered to American Aquatic Testing, Inc. (AAT) and evaluated for toxicity using a 20-day solid phase exposure with the midge *Chironomus tentans* [1]. Following the exposure period, surviving test organisms from the sediments collected in the study area were compared to a control set tested under similar conditions using sediment of known environmental quality. The endpoints used for determination of an impact in the midge exposures were mortality, measured as mean survival, and growth, measured as mean dry weight.

MATERIALS AND METHODS / *Chironomus tentans*

Surface sediment samples were collected at stations adjacent to the Matteo Iron and Metals facility in Gloucester County, New Jersey. Station locations were selected to represent areas that may have been impacted by the facility's operations. Sediment samples were also taken at stations in the surrounding area for the purpose of making reference comparisons.

Preparation of sediment samples for testing

The sediment samples collected on August 18, 19 and 20 2003, were transported to the Severn Trent Laboratories facility in Edison, NJ and picked up by AAT personnel on August 21, 2003. Samples were collected in 2.5-gallon high-density polyethylene (HDPE) containers and transported on ice. Upon arrival at AAT on August 21, 2003, the samples were refrigerated until being used for testing on September 3, 2003. These samples were not altered other than to remove large debris and organic material (larger than ~3 cm) before testing.

Control sediment used to assess the health of the test organisms used for testing was collected from the Spruce Run Reservoir in Clinton, NJ on August 26, 2003 and was screened on-site using a #18 mesh screen to remove large debris and indigenous organisms. Screened sediment was placed in a five gallon HDPE container for transport to the laboratory and refrigerated until used for testing on September 3, 2003. Control sediment was analyzed for grain size, and total organic carbon (TOC) by Severn Trent Laboratories in Edison, NJ. The results of these analyses are included in Appendix A.

Test organisms

Study chironomids (*Chironomus tentans*) egg cases used to supply larval test organisms for the study were obtained from stock cultures maintained by Aquatic Biosystems, Inc. of Fort Collins, CO and were received in-house on September 3, 2003. Prior to testing, the organisms were held under conditions similar to that which they would encounter during the test (see Table I). The midges were not fed prior to test initiation. At the beginning of the 20-day exposure, the test organisms were <24 hours old. The age group used to conduct this test did however fall within the acceptable age range for this procedure [1].

A reference toxicant test using potassium chloride was conducted concurrently with the 20-day exposure to assess the sensitivity of the lot of organisms used in the sediment test. The 48 hr LC₅₀ produced was 2301.1 ppm. This test value falls within the range of the data set AAT is currently developing for this species. A copy of the raw data is included with the other raw data for this test in Appendix A.

Experimental procedures

The entire sediment exposure series for this project consisted of ten sediment samples from the study area and one of control sediment from Spruce Run Reservoir. Test chambers (300 mL tall form borosilicate glass beakers) were filled with 100 mL of sediment. 175 mL of test water was poured over the sediment gently to cause minimal disturbance. There were five replicate chambers for each station treatment. Test chambers were allowed to settle for 24 hours prior to test initiation.

After the settling period, the overlying water was siphoned off and fresh water was introduced, using a small, round HDPE disk suspended over the sediment to deflect the water flow and minimize disturbance to the sediment. Water quality data including alkalinity, ammonia, conductivity, dissolved oxygen, temperature, pH, and hardness were measured initially on composite water samples from all samples, prior to the introduction of test organisms, and at the end of the 20-day exposure for each sample and the control. Conductivity was also measured at 7 and 14 days in all samples and the control. The dissolved oxygen, pH and temperature were also measured initially and every 24 hours thereafter for the duration of the exposure for each sample and the control.

The exposure period began by placing 12 randomly selected test organisms into each chamber. Care was taken to ensure that the organisms were released beneath the surface of the overlying water to keep air bubbles from forcing the organisms to the surface. Test chambers were fed once a day during the exposure period with a slurry of dry fish flake food and deionized water to deliver approximately 4 mg/L to each chamber. Test conditions are summarized in Table I.

Observations were made and recorded for each chamber each day during the exposure period to assess organism health. Observations included the number of organisms dead, swimming, on the surface of the sediment or on the surface of the water. Dissolved oxygen, pH and temperature were measured and recorded each day from a new replicate chamber for each sample and the control. During the 20 days of the test, each chamber would be used for recordings four times. 150 mL of the overlying water was siphoned off twice a day and replaced using reconstituted water as a measure to maintain sufficient dissolved oxygen levels. Care was taken to minimize disturbance of the sediment during water renewal by using the small HDPE disc.

At the end of the 20-day exposure the final alkalinity, ammonia, conductivity, hardness, dissolved oxygen, pH and temperature were measured, and the test chambers were prepared for the removal of test organisms. With the overlying water present in each chamber, the top 20% of sediment was gently stirred into suspension. The slurry was then poured into a #60 mesh screen (250 μ m) and rinsed in a shallow pan of laboratory water to remove the finer grains of the sediment. Sediment remaining in the sieve was placed into a second shallow pan of water over a light table, and carefully sorted to find the surviving test organisms. Using additional laboratory water, this process was repeated two or three times for each replicate until all the sediment had been inspected. All surviving organisms were transferred to a 30 mL soufflé cup for live count verification and preparation for weight determination. Pupae were counted for survival purposes, but were not included in the weight analysis.

When all test chambers had been sieved and the number of survivors verified, the test organisms were sacrificed using ethanol. The test organisms were then placed on tared aluminum weigh pans, which had been initially dried and weighed on September 23, 2003, dried for six hours at 105° C, and then transferred to a dessicator to cool before dry weight determination. Final dry weights were recorded on September 25, 2003.

Data analysis

Data analysis was performed following procedures published by the USEPA [1] using the Toxstat [2] data analysis software. Survival data, in the form of proportion of survivors in each chamber, was transformed by arcsine squareroot and then tested for normality using the Shapiro-Wilk's test or the Chi-Square test and for homogeneity of variance using Bartlett's test, as appropriate. Analysis of variance (ANOVA) followed by Dunnett's *a posteriori* pairwise comparisons or Steel's Many-One Rank test, as appropriate, to evaluate differences between stations and the control sample.

TABLE I: Summary of Conditions for *Chironomus tentans* Toxicity Test

1.	Test type;	Whole sediment, static, daily renewal
2.	Temperature;	23.0 +/- 1.0° C
3.	Light quality;	Wide-spectrum fluorescent illumination
4.	Light intensity;	50 - 100 foot-candles
5.	Photoperiod;	16 hours light, 08 hours dark
6.	Test chamber size;	300 mL high form borosilicate glass beakers
7.	Sediment volume;	100 mL / replicate
8.	Overlying water volume;	175 mL / replicate
9.	Renewal;	2 volume exchanges per day
10.	Age of test organisms;	<24 hours
11.	Number organisms / container;	12
12.	Replicates;	5
13.	Feeding;	4.0 mg flake fish food / day
14.	Aeration;	None unless dissolved oxygen concentrations ≤ 2.5 ppm, then ~ 100 bubbles / min.
15.	Overlying water;	Laboratory reconstituted water
16.	Test chamber cleaning;	Only if necessary
17.	Overlying water quality;	D. O., pH and temperature daily; alkalinity, ammonia, conductivity, hardness & pH at beginning and end of test, conductivity @ 7, 14, 21 days
18.	Test duration;	20 days
19.	Effects measured;	Survival and growth as mean dry weight
20.	Test acceptability;	Minimum control survival 70 %, minimum dry weight 0.6 mg

RESULTS

Effects on Survival / Control Sample

Raw data appear at the end of this Appendix. Data were arcsine square root transformed. The data were found to be normally distributed, were tested for homogeneity of variances using Bartlett's test, and found to be homogeneous. It was therefore determined that parametric analyses were appropriate, and ANOVA followed by Dunnett's pairwise comparisons were used to determine differences between survival of organisms in station sediments and the control sample.

Results from the analysis, which compared survival in station sediments with survival of organisms exposed to the control sample, are presented in Table II and at the end of this Appendix.

Of the ten stations in the study area, station 4 caused 100% mortality and was eliminated from analysis. Stations 8 and 9 did not produce mortality statistically different from the control exposure. Chironomids exposed to sediment from stations 1, 2, 3, 5, 6, 7 and 10 had significantly less survival than those exposed to the control treatment, and were not included in weight determinations.

It should be noted here that the recommended minimum control survival for chironomids in a 20-day exposure is 70% and this data set produced control survival of 66.7%. This decreased survival in the control may be an artifact of the handling procedures of the newly hatched test organisms during their placement into the test chambers. Since the <24 hour old midge larvae need to be sorted under a dissecting microscope to facilitate their removal from the egg case debris, they are not placed in an interim holding vessel prior to introduction to the test chambers. They are placed directly into the test exposure chambers and this limits the amount of observation time to replace those individuals that may have been adversely affected by handling. As the survival rates for the station samples are markedly lower than the controls, this slight depression in the control survival does not appear to have any adverse impact on the data analysis.

Table II. Percent survival of *C. tentans* by replicate chamber & survival comparison using control sample

Replicate	Station										
	Control	1	2	3	4*	5	6	7	8	9	10
A	58.3	50	33.3	0	0	16.7	33.3	16.7	50	8.3	16.7
B	66.7	50	8.3	16.7	0	25	58.3	8.3	75	41.7	16.7
C	58.3	33.3	16.7	0	0	50	0	8.3	58.3	58.3	41.7
D	75	0	66.7	0	0	16.7	50	16.7	100	66.7	8.3
E	75	0	0	8.3	0	16.7	25	33.3	66.7	33.3	33.3
Mean Survival	66.7	26.7	25	5	0	25	33.3	16.7	70	41.7	23.3
Statistically Different From Control	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes

* - Sample not included in ANOVA due to 100 % mortality

Effects on Growth / Control Sample

Raw data are presented at the end of this Appendix. The data were found to be normally distributed, were tested for homogeneity of variances using Bartlett's test, and found to be homogeneous. It was therefore determined that parametric analyses were appropriate, and ANOVA followed by Dunnett's pairwise comparisons were used to determine differences between growth of organisms in station sediments and the control sample.

Results from the analysis, which compared mean dry weights for stations 8 and 9 to the control sample, are presented in Table III and at the end of this Appendix.

Of the two stations that did not exhibit excessive mortality compared to the control sample, neither produced mean dry weights significantly different from the control exposure.

Table III. Mean dry weight (mg.) of *C. tentans* by replicate chamber & growth comparison using control

Replicate	Station		
	Control	8	9
A	0.789	0.583	1.98
B	0.768	0.550	0.516
C	0.670	0.624	0.579
D	0.450	0.515	0.650
E	0.48	0.695	0.998
Mean Dry Wt. - mg.	0.645	0.593	0.945
Statistically Different From Control	-	No	No

REFERENCES

[1] Ingersoll, C.G., G.A. Burton, T.D. Dawson, F.W. Dwyer, D.S. Ireland, R.A. Hoke, N.E. Kemble, D.R. Mount, T.J. Norberg-King, P.K. Sibley, and L. Stahl 2000 Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates EPA 600/R-99/064. U.S. Environmental Protection, Office of Science and Development, Duluth, MN

[2] Toxstat March, 1994 Version 3.4 data analysis software published by West, Inc. Western EcoSystems Technology, Inc., Cheyenne, WY

RAW DATA FOR *Chironomus tentans* 20-DAY
SURVIVAL AND GROWTH TEST

Job Number: 173-01-01
 Species: C. tentans

Beginning Date & Time: 9-3-03 1705
 Ending Date & Time: 09-23-03 1800

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

		Day													
Conc.	Rep.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Control	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Site 1	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Site 2	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Site 3	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Site 4	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Initials		AD	AD	MP	2	JK	MP	MP	MP	MP	MP	MP	MP	MP	MP
Date		9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations

Comments:

① worm removed up 9/12

Job Number: 173-01-01
 Species: C. tentans

Beginning Date & Time: 9-3-03 170
 Ending Date & Time: 09-23-03 1800

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

Observations/Live Count																	Day 28	
Day																	Observe	Final Count
Conc.	Rep.	14	15	16	17	18	19	20	21	22	23	24	25	26	27			
Control	A	B	B	B	B	B	B	B									7	
	B	B	B	B	B	B	B	B									8	
	C	B	B	B	B	B	B	B									7	
	D	N	B	B	B	B	B	B									9	
	E	B	B	B	B	B	B	B									9	
Site 1	A	B	B	B	B	B	B	B									8	
	B	B	B	B	B	B	B	B									6	
	C	B	B	N	B	B	B	B									4	
	D	B	B	B	B	B	B	B									0	
	E	B	B	B	B	B	B	B									0	
Site 2	A	B	B	B	B	B	B	B									4	
	B	B	B	B	B	B	B	B									1	
	C	B	B	B	B	B	B	B									2	
	D	B	B	B	N	B	B	B									8	
	E	B	B	B	B	B	B	B									0	
Site 3	A	B	B	B	B	B	B	B									0	
	B	B	B	B	B	B	B	B									2	
	C	B	B	B	B	B	B	B									0	
	D	B	B	B	B	B	B	B									0	
	E	B	B	B	B	B	B	B									1	
Site 4	A	B	B	B	B	B	B	B									0	
	B	B	B	B	B	B	B	B									0	
	C	B	B	B	B	B	B	B									0	
	D	B	B	B	B	B	B	B									0	
	E	B	B	B	B	B	B	B									0	
Initials		TAP	TAP	TAP	TAP	FF	TAP	TAP									TAP	
Date		9/17	9/18	9/19	9/20	9/21	9/22	9/23									9/23	
normal activity: B = no observations																		

Key: D=dead, N=normal activity, A=abnormal activity B=no observations

Comments:

Job Number: 173-01-01
 Species: C. tentans

Beginning Date & Time: 9-3-03 1705
 Ending Date & Time: 09-23-03 1800

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

		Day													
Conc.	Rep.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Site 5	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Site 6	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Site 7	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Site 8	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Site 9	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Initials		MD	MD	MD	MD	MD	MD	MD	MD	MD	MD	MD	MD	MD	MD
Date		9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations

Comments: ① SC, SD ? OLIGONEURATES 09/18/03
 ② 6E 5 PRESENT 9/14

Job Number: 173-01-01
Species: C. tentans

Beginning Date & Time: 9-3-03 1705
Ending Date & Time: 09-23-03 1800

Freshwater Sediment Test
American Aquatic Testing, Inc.,
Observations/Live Count

Observations/Live Count																	Day 28	
Day																	Observ	Final Count
Conc.	Rep.	14	15	16	17	18	19	20	21	22	23	24	25	26	27			
Site 5	A	B	B	B	B	B	B	B									2	
	B	B	B	B	B	B	B	B									3	
	C	B	B	B	B	B	B	B									6	
	D	B	B	B	B	B	B	B									2	
	E	B	B	B	B	B	B	B									2	
Site 6	A	B	B	B	B	B	B	B									4	
	B	B	B	B	B	B	B	B									7	
	C	B	B	B	B	B	B	B									0	
	D	B	B	B	B	B	B	B									6	
	E	B	B	B	B	B	B	B									3	
Site 7	A	B	B	B	B	B	B	B									2	
	B	B	B	B	B	B	B	B									1	
	C	N	B	B	B	B	B	B									1	
	D	B	B	B	B	B	B	B									2	
	E	B	B	B	B	B	B	B									4	
Site 8	A	B	B	B	B	B	B	B									6	
	B	B	B	B	B	B	B	B									9	
	C	B	B	B	B	B	B	B									7	
	D	B	B	B	B	B	B	B									10	
	E	B	B	B	B	N	B	B									8	
Site 9	A	B	B	B	B	B	B	B									1	
	B	B	B	B	B	B	B	B									5	
	C	B	B	B	B	B	B	B									7	
	D	N	B	B	B	B	B	B									8	
	E	B	B	B	B	B	B	B									4	
Initials		TAP	TAP	TAP	TAP	JP	TAP	TAP									TAP	
Date		9/17	9/18	9/19	9/20	9/21	9/22	9/23									9/23	
No abnormal activity. No observations																		

Key: D=dead, N=normal activity, A=abnormal activity B=no observations

Comments: ① 12 09/23 CJ

Job Number: 173-01-01
 Species: C. tentans

Beginning Date & Time: 9-3-03 1705
 Ending Date & Time: 9-23-03 1800

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

Conc.	Rep.	Day													
		0	1	2	3	4	5	6	7	8	9	10	11	12	13
Site 10	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
/	A														
	B														
	C														
	D														
	E														
/	A														
	B														
	C														
	D														
	E														
/	A														
	B														
	C														
	D														
	E														
/	A														
	B														
	C														
	D														
	E														
Initials		MP	MP	MP	MP	MP	MP	MP	MP	MP	MP	MP	MP	MP	MP
Date		9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations

Comments:

Job Number: 173-01-01
 Species: C. tentans

Beginning Date & Time: 9-3-03 1705
 Ending Date & Time: 9-23-03 1730

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

Observations/Live Count																	Day 28	
Day																	Observ	Final Count
Conc.	Rep.	14	15	16	17	18	19	20	21	22	23	24	25	26	27			
Site 10	A	B	B	B	B	B	B	B									2	
	B	B	B	B	B	B	B	B									2	
	C	B	B	B	B	B	B	B									5	
	D	B	B	B	B	B	B	B									1	
	E	B	B	B	B	B	B	B									4	
/	A																	
	B																	
	C																	
	D																	
	E																	
/	A																	
	B																	
	C																	
	D																	
	E																	
/	A																	
	B																	
	C																	
	D																	
	E																	
/	A																	
	B																	
	C																	
	D																	
	E																	
Initials		TAP	TAP	TAP	TAP	JF	TAP	TAP									TAP	
Date		9/17	9/18	9/19	9/20	9/21	9/22	9/23									9/23	

abnormal activity. B=no observations

Key: D=dead, N=normal activity, A=abnormal activity B=no observations

Comments: _____

Client/Toxicant: 173
 Project Number: 01-01
 Species: C. tentans

Beginning Date & Time: 9-3-03 1705
 Ending Date & Time: 9-23-03 1800
 Hatch Date: 09-03-03

American Aquatic Testing, Inc.
 Weight Data

Cone.	Rep	Pan #	A weight of boat (g)	B weight of boat & org. (g)	(B-A)*1000=C dry weight of organisms (mg)	D # of surviving org.	C/D mean dry weight (mg)	C/E IC ₂₅ & NOEC calc. weight (mg)
Control	A	1	0.01140	0.01692	5.52	7	0.789	
	B	2	0.01227	0.01841	6.14	8	0.768	
	C	3	0.01025	0.01494	4.69	7	0.670	\bar{x} 0.645
	D	4	0.00952	0.01357	4.05	9	0.450	
	E	5	0.01242	0.01735	4.93	9	0.548	
	F							
	G							
Site 1	A	6	0.01111	0.01397	2.86	6	0.477	
	B	7	0.01079	0.01387	3.08	6	0.513	\bar{x} 0.359
	C	8	0.00821	0.00856	0.35	4	0.088	0.216
	D	9	0.00985	-	-	0	-	
	E	10	0.00942	-	-	0	-	
	F							
	G							
Site 2	A	11	0.00991	0.01286	2.95	4	0.738	
	B	12	0.00995	0.01230	2.35	1	0.235	\bar{x} 1.143
	C	13	0.00904	0.01056	1.52	2	0.760	0.914
	D	14	0.00958	0.01537	6.79	8	0.724	
	E	15	0.00896	-	-	0	-	
	F							
	G							
Site 3	A	16	0.01001	-	-	0	-	
	B	17	0.00935	0.00996	0.61	2	0.305	
	C	18	0.00893	-	-	0	-	\bar{x} 0.398
	D	19	0.00751	-	-	0	-	0.159
	E	20	0.00975	0.01024	0.49	1	0.490	
	F							
	G							
Initials			<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
Date			<u>09/23</u>	<u>09/25</u>	<u>09/25</u>	<u>09/23</u>	<u>09/25</u>	<u>09/25</u>

E = Original number of organisms at test initiation, adjusted for losses.

Observations: ① 0.013872 9/21/03
 ② 2.35 3

Client/Toxicant: 173
 Project Number: 01-01
 Species: C. tentans

Beginning Date & Time: 9-3-83 1705
 Ending Date & Time: 09-23-83 1800
 Hatch Date: 09-03-83

American Aquatic Testing, Inc.
 Weight Data

Cone.	Rep	Pan #	A weight of boat (g)	B weight of boat & org. (g)	(B-A)*1000=C dry weight of organisms (mg)	D # of surviving org.	C/D mean dry weight (mg)	C/E IC ₂₅ & NOEC calc. weight (mg)
Site 4	A	21	0.00944	-	-	0	-	
	B	22	0.01101	-	-	0	-	
	C	23	0.01045	-	-	0	-	\bar{x} 0
	D	24	0.01190	-	-	0	-	
	E	25	0.01005	-	-	0	-	
	F							
	G							
	H							
Site 5	A	26	0.01095	0.01399	3.04	2	1.52	
	B	27	0.01113	0.01411	2.98	3	0.993	\bar{x} 0.867
	C	28	0.01084	0.01341	3.17	6	0.528	
	D	29	0.01061	0.01177	1.16	2	0.580	
	E	30	0.00929	0.01072	1.43	2	0.715	
	F							
	G							
	H		0					
Site 6	A	31	0.00929	0.01350	2.46	4	0.613	
	B	32	0.01405	0.01420	4.91	7	0.701	\bar{x} 0.601
	C	33	0.00952	-	-	0	-	0.481
	D	34	0.00857	0.01179	3.22	6	0.537	
	E	35	0.01006	0.01172	1.66	3	0.553	
	F							
	G							
	H							
Site 7	A	36	0.01055	0.01246	1.91	2	0.955	
	B	37	0.00972	0.01156	1.84	1	1.840	\bar{x} 1.436
	C	38	0.00931	0.01072	1.41	1	1.410	
	D	39	0.00986	0.01367	3.81	2	1.910	
	E	40	0.01020	0.01445		4	1.063	
	F							
	G							
	H							
Initials			<u>SV</u>	<u>SV</u>	<u>SV</u>	<u>SV</u>	<u>SV</u>	<u>SV</u>
Date			<u>09/28</u>	<u>09/25</u>	<u>09/25</u>	<u>09/23</u>	<u>09/25</u>	<u>09/25</u>

E = Original number of organisms at test initiation, adjusted for losses.

Observations: ① 0.01105 20923 ② 0.00929

Client/Toxicant: 173
 Project Number: 01-01
 Species: C. tentans

Beginning Date & Time: 9-3-03 1705
 Ending Date & Time: 09-23-03 1800
 Hatch Date: 09-03-03

American Aquatic Testing, Inc.
 Weight Data

Cone.	Rep	Pan #	A weight of boat (g)	B weight of boat & org. (g)	(B-A)*1000=C dry weight of organisms (mg)	D # of surviving org.	C/D mean dry weight (mg)	C/E IC ₂₅ & NOEC calc. weight (mg)
Site 8	A	41	0.00926	0.01276	3.50	6	0.583	
	B	42	0.01050	0.01545	4.95	9	0.550	\bar{x} 0.593
	C	43	0.01002	0.01439	4.32 0	7	0.624	
	D	44	0.01081	0.01699	6.18	12	0.515	
	E	45	0.00999	0.01555	5.56	8	0.695	
	F							
	G							
	H							
Site 9	A	46	0.00994	0.01192	1.98	1	1.98	
	B	47	0.01030	0.01443	4.13	5	0.516	\bar{x} 0.945
	C	48	0.00964	0.01369	4.05	7	0.579	
	D	49	0.00876	0.01396	5.20	8	0.650	
	E	50	0.00999	0.01398	3.99	4	0.998	
	F							
	G							
	H							
Site 10	A	51	0.00991	0.01132	1.41	2	0.705	
	B	52	0.00891	0.01049	1.68	2	0.790	\bar{x} 0.693
	C	53	0.01030	0.01363	3.33	5	0.666	
	D	54	0.01043	0.01067	0.24	1	0.240	
	E	55	0.00933	0.01359	4.26	4	1.065	
	F							
	G							
	H							
	A							
	B							
	C							
	D							
	E							
	F							
	G							
	H							
Initials								
Date			09/23	09/25	09/25	09/23	09/23	09/25

E = Original number of organisms at test initiation, adjusted for losses.

Observations:

① 437 09/26/03

Client/Toxicant: 173
 Job Number: 01-01
 Species: C. tentans

Beginning Date & Time: 9-3-03 1705
 Ending Date & Time: _____

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Physical / Chemical Parameters

Parameter	Concentration	Day										
		0	1	2	3	4	5	6	7	8	9	10
TEMP (C)	Control	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
	Site 1	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
	Site 2	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
	Site 3	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
	Site 4	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
	Site 5	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
	Site 6	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
	Site 7	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
	Site 8	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
	Site 9	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
	Site 10	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Dissolved Oxygen (mg/L)	Control	6.7	6.6	7.2	6.8	7.3	6.2	6.8	6.9	6.6	7.4	6.5
	Site 1	6.9	6.8	7.4	7.0	7.7	6.8	7.1	7.3	7.0	7.6	7.1
	Site 2	6.7	6.9	7.6	7.5	7.8	6.8	7.3	7.2	7.1	7.8	7.3
	Site 3	6.0	6.4	7.6	6.3	6.9	5.9	7.0	6.0	5.8	6.2	5.4
	Site 4	5.1	6.2	7.5	7.0	7.5	6.4	6.8	7.0	6.6	7.5	7.0
	Site 5	4.8	6.2	7.5	6.9	7.2	6.4	6.8	6.0	6.6	7.5	7.0
	Site 6	5.9	6.6	7.5	7.0	7.3	6.4	6.8	6.8	6.6	7.4	7.0
	Site 7	5.0	6.5	7.5	6.7	7.4	6.4	6.9	6.9	6.5	7.5	7.0
	Site 8	5.8	6.5	7.6	6.7	7.4	6.4	7.1	6.7	6.7	7.5	7.0
	Site 9	5.5	6.5	7.6	6.8	7.4	6.4	7.1	6.7	6.6	7.3	7.0
	Site 10	5.8	6.7	7.6	7.2	7.6	6.4	7.1	6.8	6.9	7.7	7.0
pH	Control	7.3	7.2	7.7	7.6	7.7	7.7	7.8	7.8	7.8	8.0	7.9
	Site 1	7.3	7.3	7.7	7.7	7.8	7.6	7.6	7.8	7.8	7.9	7.9
	Site 2	7.2	7.3	7.7	7.7	7.8	7.6	7.5	7.8	7.7	7.8	7.9
	Site 3	7.2	7.3	7.7	7.6	7.8	7.5	7.5	7.7	7.6	7.8	7.6
	Site 4	7.2	7.3	7.7	7.6	7.8	7.5	7.5	7.7	7.6	7.7	7.7
	Site 5	7.1	7.2	7.7	7.6	7.8	7.5	7.5	7.7	7.6	7.8	7.8
	Site 6	7.2	7.3	7.7	7.6	7.8	7.5	7.5	7.7	7.6	7.8	7.8
	Site 7	7.2	7.4	7.7	7.7	7.8	7.5	7.6	7.7	7.7	7.8	7.8
	Site 8	7.2	7.3	7.7	7.7	7.8	7.5	7.6	7.6	7.7	7.8	7.8
	Site 9	7.2	7.4	7.7	7.7	7.8	7.5	7.6	7.7	7.7	7.8	7.8
	Site 10	7.2	7.4	7.7	7.7	7.8	7.5	7.5	7.7	7.7	7.8	7.8
Initials		AS	AS	MP	JP	JP	AS	MP	MP	AS	MP	MP
Date		9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13

Concentration	Cond. (umhos)		Alkalinity (mg/L)		Hardness (mg/L)		Ammonia (mg/L)	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Control	275	275	60	70	80	100	0.04	0.01
Site 1	275	275	70	60	70	110	0.00	0.00
Site 2	275	275	70	70	80	100	0.00	0.00
Site 3	275	275	60	70	80	100	0.10	0.00
Site 4	275	280	60	60	80	100	0.00	0.00
Site 5	280	270	70	70	70	90	0.13	0.02
Site 6	270	270	60	70	70	100	0.13	0.00
Site 7	280	280	70	70	80	90	0.16	0.01
Site 8	280	275	70	70	80	110	0.15	0.00
Site 9	280	275	70	70	80	110	0.23	0.00
Site 10	270	280	50	60	80	100	0.09	0.00
Initials	AS	MP	AS	AS	AS	AS	AS	MP
Date	9/3	9/10	9/3	9/23	9/3	9/23	9/3	9/23

Comments: Day 7

Client/Toxicant: 173
 Job Number: 01-01
 Species: C. tentans

Beginning Date & Time: 9-3-03 1705
 Ending Date & Time: _____

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Physical / Chemical Parameters

Parameter	Concentration	Day											
		11	12	13	14	15	16	17	18	19	20	21	
TEMP (C)	Control	23.0	22.0	23.0	22.0	22.5	22.0	23.0	22.0	23.0	22.5		
	Site 1	23.0	22.0	23.0	22.0	22.5	22.0	23.0	22.0	23.0	22.5		
	Site 2	23.0	22.0	23.0	22.0	22.5	22.0	23.0	22.0	23.0	23.0		
	Site 3	23.0	22.0	23.0	22.0	22.5	22.0	23.0	22.0	23.0	22.5		
	Site 4	23.0	22.0	23.0	22.0	22.5	22.0	23.0	22.0	23.0	22.0		
	Site 5	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.0	23.0	23.0		
	Site 6	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.0	23.0	22.0		
	Site 7	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.0	23.0	22.0		
	Site 8	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.0	23.0	22.0		
	Site 9	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.0	23.0	22.0		
	Site 10	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.0	23.0	22.0		
Dissolved Oxygen (mg/L)	Control	6.8	6.8	6.7	6.8	6.9	6.7	6.9	6.2	6.0	6.3		
	Site 1	7.3	7.0	6.9	7.1	6.9	7.3	7.2	6.3	6.2	6.7		
	Site 2	7.5	7.3	7.1	7.3	7.1	7.3	7.0	6.6	6.1	6.9		
	Site 3	5.6	5.8	6.1	6.4	6.0	6.2	5.8	6.2	4.9	5.3		
	Site 4	7.4	6.7	6.7	6.9	6.9	6.8	6.9	6.4	5.7	6.7		
	Site 5	7.3	6.7	6.5	6.9	6.9	6.2	6.6	5.2	4.8	5.7		
	Site 6	7.3	6.6	6.3	6.6	6.8	6.1	6.5	6.0	4.8	5.9		
	Site 7	7.2	6.7	6.2	6.7	6.8	6.5	6.9	5.7	5.6	6.4		
	Site 8	7.2	6.9	6.4	6.9	6.8	7.0	6.8	5.6	5.5	6.1		
	Site 9	7.2	6.9	6.4	7.0	6.9	6.4	6.6	6.4	5.4	6.2		
	Site 10	7.2	7.0	6.5	7.0	6.9	7.1	7.0	6.3	5.7	7.0		
pH	Control	7.9	7.6	7.7	7.7	7.8	7.9	7.8	7.7	7.7	7.6		
	Site 1	7.9	7.5	7.6	7.7	7.8	7.8	7.8	7.7	7.6	7.7		
	Site 2	7.8	7.5	7.5	7.6	7.7	7.7	7.8	7.7	7.6	7.6		
	Site 3	7.6	7.5	7.4	7.4	7.4	7.9	7.7	7.7	7.5	7.6		
	Site 4	7.8	7.5	7.3	7.6	7.8	7.8	7.8	7.7	7.5	7.6		
	Site 5	7.8	7.7	7.6	7.6	7.8	8.3	7.8	7.7	7.7	7.6		
	Site 6	7.8	7.5	7.6	7.6	7.8	8.1	7.9	7.7	7.7	7.6		
	Site 7	7.8	7.6	7.6	7.7	7.8	8.1	7.9	7.8	7.7	7.6		
	Site 8	7.8	7.5	7.5	7.7	7.8	7.9	7.7	7.8	7.7	7.7		
	Site 9	7.8	7.5	7.5	7.6	7.8	7.9	7.8	7.8	7.6	7.7		
	Site 10	7.9	7.5	7.5	7.7	7.8	7.9	7.8	7.8	7.6	7.7		
Initials		MD	MD	MD	MD	MD	MD	MD	MD	MD	MD		
Date		9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23		

Concentration	Cond. (umhos)		Alkalinity (mg/L)		Hardness (mg/L)		Ammonia (mg/L)		Comments
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
Control	280	290							Day 14 Day 21
Site 1	280	285							
Site 2	280	290							
Site 3	280	290							
Site 4	280	285							
Site 5	275	300							
Site 6	275	290							
Site 7	280	295							
Site 8	270	290							
Site 9	270	290							
Site 10	270	285							
Initials		MD	MD						
Date		9/17	9/23						

Job Number: 173-01-01
Species: C. tentans

Start Date & Time: 9-3-03 1705
End Date & Time: _____

Sediment Test
American Aquatic Testing, Inc.,
Water Change Log/Initial Water Readings/General Testing Information

Test Day	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Morning change(time)	0930	0950	1020	0930	0900	0920	0910	0800	0745	0830	0700	1000	0730	0800	0745
D.O. mg/L	7.6	7.5	8.0	7.7	8.5	7.2	8.4	8.6	8.6	8.6	8.4	8.2	8.2	8.6	8.5
pH	7.4	8.0	7.9	7.9	8.3	7.8	8.2	8.2	8.2	8.4	8.1	8.0	8.1	8.1	8.2
Temp. (C)	24.0	24.0	24.0	23.0	22.5	23.0	22.0	22.5	22.5	23.0	23.0	22.5	22.5	22.5	22.5
Initials	MP	MP	MP	MP	JL	MP	MP	MP	MP	MP	MP	MP	MP	MP	MP
Date	9/3	9/4	9/5	09/06	09/07	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17
Afternoon change(time)	1725	1730	1700	1850	1630	1630	1610	1610	1610	1700	1730	1730	1800	1710	1800
D.O. mg/L	7.6	7.6	8.3	8.5	8.7	7.9	8.4	8.2	8.2	8.5	8.2	8.1	8.1	8.0	8.4
pH	7.6	7.9	7.6	8.3	8.3	7.8	7.6	7.6	7.7	8.1	7.9	7.9	7.9	7.9	8.0
Temp. (C)	23.5	22.5	22.0	22.0	22.0	23.5	22.0	22.5	22.5	22.5	22.5	22.5	22.0	23.5	23.0
initials	MP	MP	JL	JL	JL	MP	MP	MP	MP	JL	MP	MP	MP	MP	MP
Date	9/3	9/4	9/5	9/5	9/6	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17

Test Day	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Morning change(time)	0730	0900	0900	0900	0745	0930								
D.O. mg/L	8.2	8.6	8.3	8.4	8.0	8.0								
pH	8.2	8.2	8.1	8.2	8.0	7.9								
Temp. (C)	22.5	22.0	22.5	22.0	22.5	22.0								
Initials	JL	JL	JL	JL	JL	JL								
Date	9/18	9/19	09/20	9/21	9/22	09/23								
Afternoon change(time)	1700	1800	1730	1930	1700									
D.O. mg/L	8.2	8.9	8.2	8.1	7.9									
pH	7.8	7.7	7.9	7.8	8.0									
Temp. (C)	23.0	22.0	23.0	22.0	22.0									
Initials	MP	MP	JL	JL	MP									
Date	9/18	9/19	9/20	09/21	9/22									

Control Sed. collection date/by: 8-26-03/TAP Organism source: ABS Inc. Test Chamber size: 300ml
Control Sed. sieve date/by: 8-26-03/MP Test organism Lot number: 640 Test Volume of sediment: 100ml
Sieve size used: 18 Number of animals per chamber: 12 Test Volume of water: 175ml
Sample sieve date/by: N/A Food Type: Tetramin slurry Test Duration: 20 days
Sieve size used: N/A Frequency of feeding: 1x a day Test Temperature Range: 23±1°C

① 9/7 ② 8.2 JL 9/10

STATISTICAL DATA FOR *Chironomus tentans* 20-DAY
SURVIVAL
USING CONTROL SEDIMENT

Matteo Metals C. tentans surv. start date 09/03/03
File: D:\TOXSTAT\1730101C.TSU Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 2.030

W = 0.971

Critical W (P = 0.05) (n = 50) = 0.947

Critical W (P = 0.01) (n = 50) = 0.930

Data PASS normality test at P=0.01 level. Continue analysis.

Matteo Metals C. tentans surv. start date 09/03/03
File: D:\TOXSTAT\1730101C.TSU Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated Bl statistic = 11.34

Table Chi-square value = 21.67 (alpha = 0.01, df = 9)

Table Chi-square value = 16.92 (alpha = 0.05, df = 9)

Data PASS Bl homogeneity test at 0.01 level. Continue analysis.

Matteo Metals C. tentans surv. start date 09/03/03

File: D:\TOXSTAT\1730101C.TSU

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	5	0.869	1.047	0.958
2	SITE 1	5	0.145	0.785	0.495
3	SITE 2	5	0.145	0.956	0.486
4	SITE 3	5	0.145	0.421	0.230
5	SITE 5	5	0.421	0.785	0.514
6	SITE 6	5	0.145	0.869	0.588
7	SITE 7	5	0.292	0.615	0.408
8	SITE 8	5	0.785	1.426	1.017
9	SITE 9	5	0.292	0.956	0.687
10	SITE 10	5	0.292	0.702	0.490

Matteo Metals C. tentans surv. start date 09/03/03

File: D:\TOXSTAT\1730101C.TSU

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	0.008	0.089	0.040	9.32
2	SITE 1	0.107	0.327	0.146	66.09
3	SITE 2	0.099	0.314	0.141	64.72
4	SITE 3	0.016	0.125	0.056	54.28
5	SITE 5	0.025	0.158	0.071	30.69
6	SITE 6	0.080	0.282	0.126	48.07
7	SITE 7	0.018	0.132	0.059	32.41
8	SITE 8	0.062	0.249	0.111	24.47
9	SITE 9	0.067	0.258	0.115	37.58
10	SITE 10	0.027	0.165	0.074	33.71

Matteo Metals C. tentans surv. start date 09/03/03

File: D:\TOXSTAT\1730101C.TSU

Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	9	2.624	0.292	5.746
Within (Error)	40	2.030	0.051	
Total	49	4.654		

Critical F value = 2.12 (0.05,9,40)

Since $F > \text{Critical } F$ REJECT H_0 : All equal

Matteo Metals C. tentans surv. start date 09/03/03

File: D:\TOXSTAT\1730101C.TSU

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST

TABLE 1 OF 2

H_0 : Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	0.958	0.667		
2	SITE 1	0.495	0.267	3.246	*
3	SITE 2	0.486	0.250	3.311	*
4	SITE 3	0.230	0.050	5.110	*
5	SITE 5	0.514	0.250	3.110	*
6	SITE 6	0.588	0.333	2.597	*
7	SITE 7	0.408	0.167	3.855	*
8	SITE 8	1.017	0.700	-0.415	
9	SITE 9	0.687	0.417	1.900	
10	SITE 10	0.490	0.233	3.280	*

Dunnett table value = 2.51 (1 Tailed Value, $P=0.05$, $df=40,9$)

Matteo Metals C. tentans surv. start date 09/03/03

File: D:\TOXSTAT\1730101C.TSU

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST

TABLE 2 OF 2

H_0 : Control < Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Control	5			
2	SITE 1	5	0.350	52.5	0.400
3	SITE 2	5	0.350	52.5	0.417
4	SITE 3	5	0.350	52.5	0.617
5	SITE 5	5	0.350	52.5	0.416
6	SITE 6	5	0.350	52.5	0.333
7	SITE 7	5	0.350	52.5	0.500
8	SITE 8	5	0.350	52.5	-0.033

FILE: Matteo Metals C. tentans surv. start date 09/03/03

FILE: D:\TOXSTAT\1730101C.TSU

TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 10

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	0.5830	0.8688
1	Control	2	0.6670	0.9557
1	Control	3	0.5830	0.8688
1	Control	4	0.7500	1.0472
1	Control	5	0.7500	1.0472
2	SITE 1	1	0.5000	0.7854
2	SITE 1	2	0.5000	0.7854
2	SITE 1	3	0.3330	0.6151
2	SITE 1	4	0.0000	0.1448
2	SITE 1	5	0.0000	0.1448
3	SITE 2	1	0.3330	0.6151
3	SITE 2	2	0.0830	0.2922
3	SITE 2	3	0.1670	0.4210
3	SITE 2	4	0.6670	0.9557
3	SITE 2	5	0.0000	0.1448
4	SITE 3	1	0.0000	0.1448
4	SITE 3	2	0.1670	0.4210
4	SITE 3	3	0.0000	0.1448
4	SITE 3	4	0.0000	0.1448
4	SITE 3	5	0.0830	0.2922
5	SITE 5	1	0.1670	0.4210
5	SITE 5	2	0.2500	0.5236
5	SITE 5	3	0.5000	0.7854
5	SITE 5	4	0.1670	0.4210
5	SITE 5	5	0.1670	0.4210
6	SITE 6	1	0.3330	0.6151
6	SITE 6	2	0.5830	0.8688
6	SITE 6	3	0.0000	0.1448
6	SITE 6	4	0.5000	0.7854
6	SITE 6	5	0.2500	0.5236
7	SITE 7	1	0.1670	0.4210
7	SITE 7	2	0.0830	0.2922
7	SITE 7	3	0.0830	0.2922
7	SITE 7	4	0.1670	0.4210
7	SITE 7	5	0.3330	0.6151
8	SITE 8	1	0.5000	0.7854
8	SITE 8	2	0.7500	1.0472
8	SITE 8	3	0.5830	0.8688
8	SITE 8	4	1.0000	1.4260
8	SITE 8	5	0.6670	0.9557
9	SITE 9	1	0.0830	0.2922
9	SITE 9	2	0.4170	0.7020
9	SITE 9	3	0.5830	0.8688
9	SITE 9	4	0.6670	0.9557
9	SITE 9	5	0.3330	0.6151
10	SITE 10	1	0.1670	0.4210
10	SITE 10	2	0.1670	0.4210
10	SITE 10	3	0.4170	0.7020
10	SITE 10	4	0.0830	0.2922
10	SITE 10	5	0.3330	0.6151

STATISTICAL DATA FOR *Chironomus tentans* 20-DAY
GROWTH
USING CONTROL SEDIMENT

Matteo Metals C. tentans grow. start date 09/03/03

File: d:\toxstat\l730101C.TGR

Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	5	0.450	0.789	0.645
2	SITE 8	5	0.515	0.695	0.593
3	SITE 9	5	0.516	1.980	0.945

Matteo Metals C. tentans grow. start date 09/03/03

File: d:\toxstat\l730101C.TGR

Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	0.021	0.145	0.065	22.46
2	SITE 8	0.005	0.070	0.031	11.74
3	SITE 9	0.370	0.608	0.272	64.37

Matteo Metals C. tentans grow. start date 09/03/03
File: d:\toxstat\1730101C.TGR Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	1.005	3.630	5.730	3.630	1.005
OBSERVED	0	6	5	3	1

Calculated Chi-Square goodness of fit test statistic = 2.7547
Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Matteo Metals C. tentans grow. start date 09/03/03
File: d:\toxstat\1730101C.TGR Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 14.80

Table Chi-square value = 9.21 (alpha = 0.01, df = 2)
Table Chi-square value = 5.99 (alpha = 0.05, df = 2)

Data FAIL B1 homogeneity test at 0.01 level. Try another transformation.

Matteo Metals C. tentans grow. start date 09/03/03

File: d:\toxstat\1730101C.TGR Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	2	0.360	0.180	1.364
Within (Error)	12	1.582	0.132	
Total	14	1.942		

Critical F value = 3.89 (0.05,2,12)

Since $F < \text{Critical } F$ FAIL TO REJECT H_0 : All equal

Matteo Metals C. tentans grow. start date 09/03/03

File: d:\toxstat\1730101C.TGR Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	0.645	0.645		
2	SITE 8	0.593	0.593	0.225	
3	SITE 9	0.945	0.945	-1.305	

Dunnett table value = 2.11 (1 Tailed Value, $P=0.05$, $df=12,2$)

Matteo Metals C. tentans grow. start date 09/03/03

File: d:\toxstat\1730101C.TGR Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Control	5			
2	SITE 8	5	0.485	75.1	0.052
3	SITE 9	5	0.485	75.1	-0.300

FILE: Matteo Metals C. tentans grow. start date 09/03/03

FILE: d:\toxstat\1730101C.TGR

TRANSFORM: NO TRANSFORMATION

NUMBER OF GROUPS: 3

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	0.7890	0.7890
1	Control	2	0.7680	0.7680
1	Control	3	0.6700	0.6700
1	Control	4	0.4500	0.4500
1	Control	5	0.5480	0.5480
2	SITE 8	1	0.5830	0.5830
2	SITE 8	2	0.5500	0.5500
2	SITE 8	3	0.6240	0.6240
2	SITE 8	4	0.5150	0.5150
2	SITE 8	5	0.6950	0.6950
3	SITE 9	1	1.9800	1.9800
3	SITE 9	2	0.5160	0.5160
3	SITE 9	3	0.5790	0.5790
3	SITE 9	4	0.6500	0.6500
3	SITE 9	5	0.9980	0.9980

CHAIN OF CUSTODY DOCUMENTATION

Report to:
Company: Louis Berger Group
Address: 30 Vreeland Road, Bldg A
Florham Park, NJ 07932
Contact: Tom Tunic
Phone: 973-678-1960 x608
Fax: 973-676-3564
Contract/
Quote:

Invoice to:
Company: Louis Berger Group
Address: 30 Vreeland Road, Bldg A
Florham Park, NJ 07932
Contact: Tom Tunic
Phone: 973-678-1960
Fax: 973-676-3564

ANALYSIS
REQUESTED

Lab Use Only
Due Date:
Temp. of coolers
when received (C°):
1 2 3 4
Custody Seal N/Y
Intact N/Y
Screened
For Radioactivity ☐

JOB: N049

Sampler's Name
Brian Janikowski

Sampler's Signature
Brian Janikowski

Proj. No.
JB-1962

Project Name
Matted Iron & Metal

No./Type of Containers?
24/1 Liter G
12/16oz A

Matrix	Date	Time	C m p	G r a b	Identifying Marks of Sample(s)	VOA	A/G 1 Lt.	250 ml	P/O	Lab/Sample ID (Lab Use Only)
S	8/19/03	1245		K	SED 6 03684 Soil	6				452971
S	8/19/03	1330		K	SED 5 03633	6				452972
S	8/19/03	1400		K	SED 4 03632	6				452973
S	8/19/03	1430		X	SED 3 03631	6				452974
S	8/19/03	1530		X	SED 2 03630	6				452975
S	8/19/03	1600		X	SED 1 18N03629	6				452976
<u>UP</u> <u>8/19</u>										

Relinquished by: (Signature)
Brian Janikowski

Date
8/19/03

Time
8:45

Received by: (Signature)
W. [Signature]

Date
8-19-03

Time
0845

Remarks
Sediment samples.

Relinquished by: (Signature)
W. [Signature]

Date
8-19-03

Time
1105

Received by: (Signature)
[Signature]

Date
8/19/03

Time

Provide N-J DEP EDD

Relinquished by: (Signature)
[Signature]

Date
8-19

Time
1315

Received by: (Signature)
[Signature]

Date

Time

Client's delivery of samples constitutes acceptance of Severn Trent Laboratories terms and conditions contained in the Price Schedule.

Matrix WW Wastewater W Water S Soil L Liquid A Air bag C Charcoal Tube SL Sludge O Oil

Container VOA 40 ml vial A/G Amber / Or Glass 1 Liter 250 ml Glass wide mouth P/O Plastic or other

STL cannot accept verbal changes.
Please Fax written changes to
(802) 655-1248

Sewer Trent Laboratories, Inc.

208 South Park Drive, Suite 1, Colchester, VT 05446 Tel: (802) 655-1203

CHAIN OF CUSTODY RECORD

Report to: Company: <u>Louis Berger Group</u> Address: <u>30 Vreeland Rd. Bldg A</u> <u>Florham Park, NJ 07832</u> Contact: <u>Tom Tunicco</u> Phone: <u>773-678-1960 x 609</u> Fax: <u>773-676-3564</u> Contract/Quote: _____	Invoice to: Company: <u>Louis Berger Group</u> Address: <u>30 Vreeland Rd. Bldg A</u> <u>Florham Park, NJ 07832</u> Contact: <u>Tom Tunicco</u> Phone: <u>773-678-1960 x 608</u> Fax: <u>773-676-3564</u>	ANALYSIS REQUESTED <div style="border: 1px solid black; padding: 5px; transform: rotate(-90deg); transform-origin: center;"> Toxicity PCB Lead PH TOC Grain Size </div>					
Lab Use Only Due Date: _____ Temp. of coolers when received (C): _____ <table border="1" style="width:100%"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> </table> Custody Seal: <u>N/Y</u> Intact: <u>N/Y</u> Screened For Radioactivity: <input type="checkbox"/>			1	2	3	4	5
1	2	3	4	5			

Sampler's Name: Brian Jancauskas Sampler's Signature: [Signature]

Proj. No.: JG-1962 Project Name: Matted Iron & Metal No. Type of Containers: 2 / A 1602

Matrix	Date	Time	CO	GP	Identifying Marks of Sample(s)	Matrix No.	VOA	A/G 1 LL	250 ml	P/O	Lab/Sample ID (Lab Use Only)
S	8/16/03	1200	X		SED 10	Soil	10				453149 1STN 03638
S	8/16/03	1225	X		SED 7		10				453150 1STN 03635
S	8/16/03	1245	X		SED 9		6				453151 1STN 03637
S	8/16/03	1315	X		SED 8		6				453152 1STN 03636
S	8/16/03	-	X		SEDDUP						453153

Rec'd AMERICAN AQ.

[Signature] 08/21/03
1800 HRS

Relinquished by (Signature): <u>[Signature]</u>	Date: <u>8/16/03</u>	Time: <u>1600</u>	Received by (Signature): <u>[Signature]</u>	Date: <u>8-19-03</u>	Time: <u>1600</u>	Remarks: <u>Provide NDEP EDP</u> <u>Sediment samples</u> <u>SEDDUP analyze for PCBs Lead only</u> Client's delivery of samples constitutes acceptance of Sewer Trent Laboratories terms and conditions contained in the Price Schedule.
Relinquished by (Signature): <u>[Signature]</u>	Date: <u>8/16/03</u>	Time: <u>1600</u>	Received by (Signature): <u>[Signature]</u>	Date: <u>8/16/03</u>	Time: <u>1715</u>	
Relinquished by (Signature): <u>[Signature]</u>	Date: <u>8/19/03</u>	Time: <u>1830</u>	Received by (Signature): <u>[Signature]</u>	Date: _____	Time: _____	

W - Wastewater WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil
 VOA - 40 ml vial A/G - Amber / Or Glass 1 Litr 250 ml - Glass wide mouth P/O - Plastic or other

STL cannot accept verbal changes.
Please see written changes.

STL EDISON

8/23/03 12:04 PM

148234 (07/00)

Report to: Company: <u>Louis Berger Group</u> Address: <u>30 Vireland Rd. Bldg A</u> <u>Florham Park, NJ 07932</u> Contact: <u>Tom Tanico</u> Phone: <u>973-678-1960 x 608</u> Fax: <u>973-676-3564</u> Contract/ Quote: _____										Invoice to: Company: <u>Louis Berger Group</u> Address: <u>30 Vireland Rd Bldg A</u> <u>Florham Park, NJ 07932</u> Contact: <u>Tom Tanico</u> Phone: <u>973-678-1960 x 608</u> Fax: <u>973-676-3564</u>										ANALYSIS REQUESTED <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Lab Use Only Due Date: _____</p> <p>Temp. of coolers when received (C°):</p> <table border="1" style="width:100%; text-align: center;"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td> </tr> </table> <p>Custody Seal N / Y</p> <p>Intact N / Y</p> <p>Screened For Radioactivity <input type="checkbox"/></p> </div>										1	2	3	4	5
1	2	3	4	5																														
Sampler's Name <u>Brian Janikowski</u>										Sampler's Signature <u>Brian Janikowski</u>																								
Proj. No. <u>SG-1982</u>			Project Name <u>Matteo Iron & Metal</u>							No/Type of Containers? <u>32 / P 11.5L</u>																								
Matrix¹	Date	Time	C	G	Grab	Identifying Marks of Sample(s)				VOA	A/G	250	P/O	<div style="transform: rotate(-90deg); font-size: 2em; font-weight: bold;">Toxicity</div>																				
S	8/20	1300		X		SED 1																		4										
S	8/20	1230		X		SED 2																		4										
S	8/20	1210		X		SED 3																		4										
S	8/20	1145		X		SED 4																		4										
S	8/20	1120		X		SED 5																		4										
S	8/20	1050		X		SED 6																		4										
S	8/20	1200		X		SED 8																		4										
S	8/20	1220		X		SED 9																		4										
														Lab/Sample ID (Lab Use Only)																				
														1STN 03629																				
														03630																				
														03631																				
														03632																				
														03633 03634																				
														03634 03635																				
														03636																				
														03637																				

Relinquished by: (Signature) <u>Brian Janikowski</u>		Date <u>8/21/02</u>	Time <u>8:30</u>	Received by: (Signature) <u>Tom Tanico</u>		Date <u>8-21-02</u>	Time <u>0840</u>	Remarks <u>provide US DEP EDD</u>
Relinquished by: (Signature) <u>Tom Tanico</u>		Date <u>8-21-02</u>	Time <u>12:00</u>	Received by: (Signature) <u>Tom Tanico</u>		Date <u>8-21-03</u>	Time <u>12:00</u>	
Relinquished by: (Signature) <u>Tom Tanico</u>		Date <u>8-21-03</u>	Time <u>1330</u>	Received by: (Signature) <u>Tom Tanico</u>		Date _____	Time _____	

Client's delivery of samples constitutes acceptance of Severn Trent Laboratories terms and conditions contained in the Price Schedule.

¹Matrix WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil

²Container VOA - 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth P/O - Plastic or other

STL cannot accept verbal changes.
Please Fax written changes to
(802) 655-1248

1105 UNION BLVD.
ALLENTOWN, PA 18103
610 434 9015

Job #: 3RS

Client: AFT, Inc.

Address: _____

Phone #:

Client Contact: CHRIS NALLY

Sample Return to client ~~AD~~
Disposal: Lab disposal 11

[illegible]

Samples were:

1. Collected by AAT personnel
Client personnel

2. Transported on ice? Yes ☒ No ☐

3. Received within holding time?
Yes ☒ No ☐

4. Sample matrix is:

Liquid ☐ Sediment ☒
Soil ☐ Other ☐

CUSTODY INFORMATION

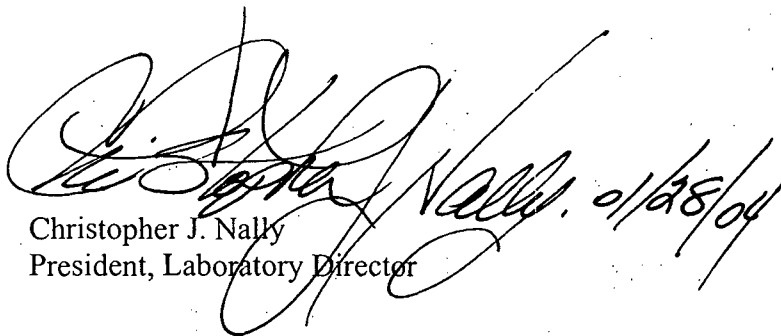
[illegible]

Appendix C

Sediment toxicity testing - *Chironomus tentans* Emergence

REPORT CERTIFICATION

The following report titled "THE LOUIS BERGER GROUP, INC. MATTEO IRON AND METALS SEDIMENT TOXICITY TESTING – *Chironomus tentans* EMERGENCE" is an accurate and truthful representation of the toxicity testing which was performed by American Aquatic Testing, Inc., located at 1105 Union Blvd. Allentown, Pennsylvania. We further certify that we have personally examined and are familiar with the information submitted in this document and based on our inquiry of those individuals immediately responsible for obtaining the information, we believe the submitted information is complete as presented. We are aware that there are significant penalties for submitting false information.



Christopher J. Nally
President, Laboratory Director



Tarmo Pallop
Vice-President, Laboratory Manager

APPENDIX C

THE LOUIS BERGER GROUP, INC.
MATTEO IRON AND METALS
SEDIMENT TOXICITY TESTING – *Chironomus tentans* EMERGENCE

Contents

<u>Section</u>	<u>Page</u>
Introduction	2
Materials and Methods; <i>Chironomus tentans</i>	2
Results	6

Tables

I.	Summary of Conditions for <i>Chironomus tentans</i> Toxicity Test	5
II.	Average time to 1 st emergence of <i>C. tentans</i> by station using stations 8 & 9 for comparison	6
III.	Total emergence of <i>C. tentans</i> by station using station 8 for comparison	7
IV.	Total emergence of <i>C. tentans</i> by station using station 9 for comparison	8
V.	Total survival of <i>C. tentans</i> by station using station 8 & 9 for comparison	9

Data

Raw data for *Chironomus tentans* emergence test

Statistical data for *Chironomus tentans* first emergence with control & reference sediment

Statistical data for *Chironomus tentans* emergence using reference station 8

Statistical data for *Chironomus tentans* emergence using reference station 9

Statistical data for *Chironomus tentans* total survival with control & reference sediment

Chain of Custody Documentation

MATTEO IRON AND METALS SEDIMENT TOXICITY TESTING -- *Chironomus tentans* EMERGENCE

INTRODUCTION

During the month of August 2003, samples of sediment were collected from the Matteo Iron and Metals facility and surrounding area in Gloucester County, New Jersey. These sediment samples were used to perform toxicity tests to determine if the tested matrices represent a significant threat to potential receptor organisms.

The sediment samples from the study area were delivered to American Aquatic Testing, Inc. (AAT) and evaluated for toxicity using a 65-day solid phase exposure with the midge *Chironomus tentans* [1]. During the exposure period, test organisms that emerged from the juvenile stage into adults from the sediments collected at the site were compared to a control set tested under similar conditions using sediment of known environmental quality. The endpoints used for determination of an impact in the midge exposures were time to first emergence in days, total emergence and total survival.

MATERIALS AND METHODS / *Chironomus tentans*

Surface sediment samples were collected at stations adjacent to the Matteo Iron and Metals facility in Gloucester County, New Jersey. Station locations were selected to represent areas that may have been impacted by the facility's operations. Sediment samples were also taken at stations in the surrounding area for the purpose of making reference comparisons.

Preparation of sediment samples for testing

The sediment samples collected on August 18, 19 and 20 2003, were transported to the Severn Trent Laboratories facility in Edison, NJ and picked up by AAT personnel on August 21, 2003. Samples were collected in 2.5-gallon high-density polyethylene (HDPE) containers and transported on ice. Upon arrival at AAT on August 21, 2003, the samples were refrigerated until being used for testing on September 3, 2003. These samples were not altered other than to remove large debris and organic material (larger than ~3 cm) before testing.

Control sediment used to assess the health of the test organisms used for testing was collected from the Spruce Run Reservoir in Clinton, NJ on August 26, 2003 and was screened on-site using a #18 mesh screen to remove large debris and indigenous organisms. Screened sediment was placed in a five gallon HDPE container for transport to the laboratory and refrigerated until used for testing on September 3, 2003. Control sediment was analyzed for grain size, and total organic carbon (TOC) by Severn Trent Laboratories in Edison, NJ. The results of these analyses are included at the end of this appendix.

Test organisms

Egg cases of the study chironomid, *Chironomus tentans*, used to supply larval test organisms for the study were obtained from stock cultures maintained by Aquatic Biosystems, Inc. of Fort Collins, CO and were received in-house on September 3, 2003. Prior to testing, the organisms were held under conditions similar to that which they would encounter during the test (see Table I). The midges were not fed prior to test initiation. At the beginning of the 65-day exposure, the test organisms were <24 hours old.

A reference toxicant test using potassium chloride was conducted concurrently with the initiation of the 65-day exposure to assess the sensitivity of the lot of organisms used in the sediment test. The 48 hr LC₅₀ produced was 2301.1 ppm. This test value falls within the range of the data set AAT is currently developing for this species. A copy of the raw data is included with the other raw data for this test in Appendix A.

Experimental procedures

The entire sediment exposure series for this project consisted of ten sediment samples from the study area and one of control sediment from Spruce Run Reservoir. Test chambers (300 mL tall form borosilicate glass beakers) were filled with 100 mL of sediment. 175 mL of test water was poured over the sediment gently to cause minimal disturbance. There were five replicate chambers for each station treatment. Test chambers were allowed to settle for 24 hours prior to test initiation.

After the settling period, the overlying water was siphoned off and fresh water was introduced, using a small, round HDPE disk suspended over the sediment to deflect the water flow and minimize disturbance to the sediment. Water quality data including alkalinity, ammonia, conductivity, dissolved oxygen, temperature, pH, and hardness were measured initially on composite water samples from all samples, prior to the introduction of test organisms, and at the end of the exposure for each sample and the control. Conductivity was also measured at 7, 14, 21, 28, 35, 42, 49 days in all samples and the control. Final conductivities were recorded as individual sample exposures ended. The dissolved oxygen, pH and temperature were also measured initially and every 24 hours thereafter for the duration of the exposure for each sample and the control.

The exposure period began by placing 12 randomly selected test organisms into each chamber. Care was taken to ensure that the organisms were released beneath the surface of the overlying water to keep air bubbles from forcing the organisms to the surface. Test chambers were fed once a day during the exposure period with a slurry of dry fish flake food and deionized water to deliver approximately 4 mg/L to each chamber. Test conditions are summarized in Table I.

Observations were made and recorded for each chamber each day during the exposure period to assess organism health. Observations included the number of organisms dead, swimming, on the surface of the sediment or on the surface of the water. Dissolved oxygen, pH and temperature were measured and recorded each day from a new replicate chamber for each sample and the control. 150 mL of the overlying water was siphoned off twice a day and replaced using reconstituted water as a measure to maintain sufficient dissolved oxygen levels. Care was taken to minimize disturbance of the sediment during water renewal by using the small HDPE disc.

Beginning on day 20, all test beakers were tightly covered using fine mesh nylon window screen and rubber bands. These covers retained emergent adults in their respective chambers so they could be recorded twice per day. Those individuals that achieved complete emergence were recorded as adult flies to be used in the statistical analysis of this endpoint. Incomplete emergence, those individuals that successfully began to emerge for the pupae, but then became caught, or expired in the process, were recorded as such but not included in the statistical analysis. There were only two individuals that were recorded as incomplete emergents.

At the end of the exposure period, described below, the final alkalinity, ammonia, conductivity, hardness, dissolved oxygen, pH and temperature were measured, and the test chambers were prepared for the removal of test organisms. With the overlying water present in each chamber, the top 20% of sediment was gently stirred into suspension. The slurry was then poured into a #60 mesh screen (250 μ m) and rinsed in a shallow pan of laboratory water to remove the finer grains of the sediment. Sediment remaining in the sieve was placed into a second shallow pan of water over a light table, and carefully sorted to find the surviving test organisms. Using additional laboratory water, this process was repeated two or three times for each replicate until all the sediment had been inspected. All surviving organisms were transferred to a 30 mL soufflé cup for live count verification.

On day 44 of the exposure, the controls reached a total emergence of 53.3% (32 of original 60 test individuals). As this was the final endpoint being assessed, the control treatment could be ended when it achieved >50% emergence of original test organisms. At this time, each test sample was then evaluated individually on a daily basis to determine when it should end. Once a station sample had not recorded a new emergent adult for seven consecutive days after the control treatment ended, that set of five replicate chambers was sieved and all remaining surviving test organisms were recorded.

Data analysis

Data analysis was performed following procedures published by the USEPA [1] using the Toxstat [2] data analysis software. Survival data, in the form of proportion of survivors in each chamber, was transformed by arcsine squareroot and then tested for normality using the Shapiro-Wilk's test or the Chi-Square test and for homogeneity of variance using Bartlett's test, as appropriate. Analysis of variance (ANOVA) followed by Dunnett's *a posteriori* pairwise comparisons or Steel's Many-One Rank test, as appropriate, to evaluate differences between stations and the control sample.

TABLE I: Summary of Conditions for *Chironomus tentans* Toxicity Test

1.	Test type;	Whole sediment, static, daily renewal
2.	Temperature;	23.0 +/- 1.0° C
3.	Light quality;	Wide-spectrum fluorescent illumination
4.	Light intensity;	50 - 100 foot-candles
5.	Photoperiod;	16 hours light, 08 hours dark
6.	Test chamber size;	300 mL high form borosilicate glass beakers
7.	Sediment volume;	100 mL / replicate
8.	Overlying water volume;	175 mL / replicate
9.	Renewal;	2 volume exchanges per day
10.	Age of test organisms;	<24 hours
11.	Number organisms / container;	12
12.	Replicates;	5
13.	Feeding;	4.0 mg flake fish food / day
14.	Aeration;	None unless dissolved oxygen concentrations ≤ 2.5 ppm
15.	Overlying water;	Laboratory reconstituted water
16.	Test chamber cleaning;	Only if necessary
17.	Overlying water quality;	D. O., pH and temperature daily; alkalinity, ammonia, conductivity, hardness & pH at beginning and end of test, conductivity @ 7-day intervals
18.	Test duration;	Approximately 50-65 days
19.	Effects measured;	Time to first emergence, total emergence and total survival
20.	Test acceptability;	Min. control survival 65 %, control emergence ≥50%

RESULTS

Effects on First Emergence / Control and Reference Samples

Raw data are presented at the end of this Appendix. The number of days each replicate took to produce the first adult was recorded as a percentage of the total time of the test exposure, 65 days. Data were arcsine square root transformed. The data were found to be normally distributed, were tested for homogeneity of variances using Bartlett's test, and found to be homogeneous. It was therefore determined that parametric analyses were appropriate, and ANOVA followed by Dunnett's pairwise comparisons were used to determine differences between survival of organisms in station sediments and the control sample.

Results from the analysis, which compared the time to first emergence in station sediments with that of stations 8 and 9, the two reference stations, are presented in Table II and at the end of this Appendix. The control values are included for comparative purposes.

Of all the stations in the study area, only station 3 was found to have a significantly greater number of days to first emergence. All remaining stations: 4, 5, 6, 7 and 10 did not produce values statistically different from either of the reference stations. Stations 1 and 2 are not included in this analysis as they were originally included as potential reference site but unacceptable survival negated their use as references.

Table II. Average time to 1st emergence of *C. tentans* by station using stations 8 & 9 for comparison

Station	Average Days to 1 st Emergence	% of 65 Day Exposure	Significant vs. station 8? ²	Significant vs. station 9? ²
Control ¹	29.2	44.9	-	-
8	31.4	48.3	-	N/A
9	30.8	47.4	N/A	-
3	51.2	78.8	YES	YES
4	41.6	64.0	No	No
5	40.8	62.8	No	No
6	36.6	56.3	No	No
7	33.6	51.7	No	No
10	31.2	51.1	No	No

1 - Control included for comparison only

2 - Reference sites not compared to each other.

Effects on Total Emergence / Control and Reference Station 8

Raw data are presented at the end of this Appendix. Data were arcsine square root transformed. The data were found to be normally distributed, were tested for homogeneity of variances using Bartlett's test, and found to be homogeneous. It was therefore determined that parametric analyses were appropriate, and ANOVA followed by Dunnett's pairwise comparisons were used to determine differences between growth of organisms in station sediments and the control sample.

Results from the analysis, which compared the total emergence in all samples with that of station 8, a reference station, are presented in Table III and at the end of this Appendix. Emergence is evaluated at seven day intervals beginning with day 44, when the control treatment reached >50% emergence. The control value is included for comparative purposes.

Reference station 8 ended on day 61, with a total emergence of 66.8%. It should be noted here that at day 44, when the control treatment surpassed the 50% emergence level, station 8 had produced 48.4% emergent adults. However, the criterion for the ending any sample treatment was no emergent individuals for seven consecutive days, so station 8 continued until day 61. Compared with station 8, stations 6 and 7 at no time showed a significant difference in total emergence on any of the days used for evaluation (44, 51, 58 & 65). Of the four remaining stations; 3, 4, 5 and 10, all had significantly less emergence at day 44 compared to station 8. At 51 days, station 3 had ended, stations 4 and 5 were still statistically different compared to station 8, and station 10 had produced sufficient numbers of adults to not be significantly different at day 51. At 58 days, station 5 had ended, and stations 4 and 10 were different from station 8. At the end of the test, day 65, station 4 had ended and station 10 was again not statistically different from station 8. Stations 3, 4 and 5 have been highlighted in the table below to show that at all points during the exposure period these stations were producing significantly different responses compared to that of station 8. The last sample from station 10, appears to have suffered some deleterious response, however the statistical analysis at day 65 did not find the final emergence of 39.4% to be different from station 8.

Table III. Total emergence of *C. tentans* by station using station 8 for comparison

Station	% Emergence @ 44 Days	Significant vs station 8 @ 44D	% Emergence @ 51 Days	Significant vs station 8 @ 51D	% Emergence @ 58 Days	Significant vs station 8 @ 58D	% Emergence @ 65 Days	Significant vs station 8 @ 65D
Control	53.4	-	-	-	-	-	-	-
8	48.4	-	61.6	-	66.8	-	66.8	
3	3.2	YES	Ended	-	-	-	-	-
4	16.4	YES	19.8	YES	19.8	YES	Ended	-
5	16.6	YES	16.6	YES	Ended	-	-	-
6	35	No	48.2	No	70	No	76.8	No
7	28.2	No	41.6	No	46.6	No	46.6	No
10	24.8	YES	34.8	No	34.8	YES	39.8	No

Effects on Total Emergence / Control and Reference Station 9

Raw data are presented at the end of this Appendix. Data were arcsine square root transformed. The data were found to be normally distributed, were tested for homogeneity of variances using Bartlett's test, and found to be homogeneous. It was therefore determined that parametric analyses were appropriate, and ANOVA followed by Dunnett's pairwise comparisons were used to determine differences between growth of organisms in station sediments and the control sample.

Results from the analysis, which compared the total emergence in all samples with station 9, the second reference station, are presented in Table IV and at the end of this Appendix. Emergence is evaluated at seven day intervals beginning with day 44, when the control treatment reached >50% emergence. The control value is included for comparative purposes.

Reference station 9 ended on day 65, with a total emergence of 71.6%. It should be noted here that at day 44, when the control treatment surpassed the 50% emergence level, station 9 had produced 45.2% emergent adults. However, the criterion for the ending any sample treatment was no emergent individuals for seven consecutive days, so station 9 continued until day 65. Compared with station 9, stations 6 and 7 at no time showed a significant difference in total emergence on any of the days used for evaluation (44, 51, 58 & 65). Of the four remaining stations; 3, 4, and 5 had significantly less emergence at day 44 compared to station 9. Station 10 was not found to be different from reference station 9. At 51 days, station 3 had ended, stations 4 and 5 were still statistically different compared to station 9, and stations 6, 7 and 10 were not significantly different. At 58 days, station 5 had ended, and stations 4 and 10 were different from station 9. At the end of the test, day 65, station 4 had ended, stations 6 and 7 ended with no difference compared to station 9, and station 10 remained statistically different from station 9. Stations 3, 4 and 5 have been highlighted in the table below to show that at all points during the exposure period these samples were producing significantly different responses compared to that of station 9.

Table IV. Total emergence of *C. tentans* by station using station 9 for comparison

Station	% Emergence @ 44 Days	Significant vs station 9 @ 44D	% Emergence @ 51 Days	Significant vs station 9 @ 51D	% Emergence @ 58 Days	Significant vs station 9 @ 58D	% Emergence @ 65 Days	Significant vs station 9 @ 65D
Control	53.4	-	-	-	-	-	-	-
9	45.2	-	58.4	-	66.8	-	71.6	
3	3.2	YES	Ended	-	-	-	-	-
4	16.4	YES	19.8	YES	19.8	YES	Ended	-
5	16.6	YES	16.6	YES	Ended	-	-	-
6	35	No	48.2	No	70	No	76.8	No
7	28.2	No	41.6	No	46.6	No	46.6	No
10	24.8	No	34.8	No	34.8	YES	39.8	YES

Effects on Total Survival / Control and Reference Samples

Raw data are presented at the end of this Appendix. Data were arcsine square root transformed. The data were found to be normally distributed, were tested for homogeneity of variances using Bartlett's test, and found to be homogeneous. It was therefore determined that parametric analyses were appropriate, and ANOVA followed by Dunnett's pairwise comparisons were used to determine differences between survival of organisms in all station sediments and the control sample.

Results from the analysis, which compared the total survival in all samples with that of stations 8 and 9, the two reference stations, are presented in Table V and at the end of this Appendix. The control values are included for comparative purposes. The remaining stations; 1, 2 and 10 were considered as alternate reference stations but unacceptable survival negated their use as references. The recommended minimum survival for the emergence portion of this test is 65% at the completion of testing. The control treatment as well as reference stations 8 and 9 exceeded this level of surviving test organisms.

Of the stations in the study area, station 3 was found to have a significantly lower survival than stations 8 and 9. Of the remaining stations, 4 and 7 were found to have statistically different survival rates when compared to station 9.

Table V. Total survival of *C. tentans* by sample location using sites 8 & 9 for comparison

Station	Total Survival %	References Significant vs Control?	Significant vs station 8? ²	Significant vs station 9? ²
Control ¹	88.3	-	-	-
1	25.0	YES	-	-
2	40.0	YES	-	-
3	50.0	-	YES	YES
4	21.7	-	No	YES
5	81.7	-	No	No
6	81.7	-	No	No
7	46.7	-	No	YES
8	68.3	No	-	N/A ²
9	80.0	No	N/A ²	-
10	55.0	YES	No ³	No ³

1 - Control included for comparison only

2 - Reference stations not compared to each other

3 - Site 10 included as site sample due to possible contamination effects

REFERENCES

[1] Ingersoll, C.G., G.A. Burton, T.D. Dawson, F.W. Dwyer, D.S. Ireland, R.A. Hoke, N.E. Kemble, D.R. Mount, T.J. Norberg-King, P.K. Sibley, and L. Stahl 2000 Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates EPA 600/R-99/064. U.S. Environmental Protection, Office of Science and Development, Duluth, MN

[2] Toxstat March, 1994 Version 3.4 data analysis software published by West, Inc. Western EcoSystems Technology, Inc., Cheyenne, WY

RAW DATA FOR *Chironomus tentans*

EMERGENCE TEST

Job Number: 173-01-01
Species: C. tentans

Hatch

Beginning Date & Time: 9-3-03 1840
Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
American Aquatic Testing, Inc.,
Observations/Live Count

Cone.	Rep.	Day													
		0	1	2	3	4	5	6	7	8	9	10	11	12	13
Control	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Site 1	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Site 2	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Site 3	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Site 4	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Initials		JD	JD	JF	JP	JF	JP	JP	MP	JP	JP	JP	JP	JP	JP
Date		9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations

Comments:

THRU
13

Job Number: 173-01-01
 Species: P. tentans

Hatch

Beginning Date & Time: 9-3-03 184
 Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

		Day													
Conc.	Rep.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Site 5	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Site 6	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Site 7	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Site 8	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Site 9	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Initials		9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16
Date		9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations

Comments:

THRU
13

Job Number: 173-01-01
 Species: C. tentans

Hate

Beginning Date & Time: 9-3-03 184
 Ending Date & Time: 11-07-03 12:00

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

		Day													
Conc.	Rep.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Site 10	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B
/	A														
	B														
	C														
	D														
	E														
/	A														
	B														
	C														
	D														
	E														
/	A														
	B														
	C														
	D														
	E														
/	A														
	B														
	C														
	D														
	E														
Initials		JD	JD	JF	JD	JF	TD	TD	MD	TD	MD	TD	TD	MD	TD
Date		9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations

Comments:

THRU
13

Job Number: 173-01-01
Species: C. tentans

H₂O₄

Beginning Date & Time: 9-3-03 1845
Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
American Aquatic Testing, Inc.,
Observations/Live Count

Observations/Live Count

Day																Day 28	
Conc.	Rep.	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Observ	Final Count
Control	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	25	8
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
Site 1	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
	C	N	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	0
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
Site 2	A	B	B	B	B	B	N	B	B	B	B	B	B	B	B	B	
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
	D	B	B	B	B	B	B	N	B	B	B	B	B	B	B	B	0
	E	N	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
Site 3 ^①	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	1P
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	1
Site 4 ^②	A	B	B	B	N	B	B	B	B	B	B	B	B	B	B	B	
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	0
Initials		TAP	TAP	TAP	TAP	IF	MP	TAP	TAP	MP	MP	MP	MP	MP	MP	MP	
Date		9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	11/1
Activity: A=abnormal activity, B=no observations, P=puce, F=FL																	

Key: D=dead, N=normal activity, A=abnormal activity B=no observations P=Pupae F=Fly

Comments:

- ① OLIGOCHAETES PRESENT
3A, 3D 9/20/03
② OLIGOCHAETES PRESENT
4C, 4E

③ TOTAL EMERGENT ADULTS AT END OF 14 DAY EXP- 14-28 DAP 9/14/03

THW
28

Job Number: 173-01-01
Species: C. tentans

Hate

Beginning Date & Time: 9-3-03 1840
Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
American Aquatic Testing, Inc.,
Observations/Live Count

Observations/Live Count																	Day 28	
Day																	Observ	Final Count
Conc.	Rep.	14	15	16	17	18	19	20	21	22	23	24	25	26	27			
Site 5	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	0	
Site 6	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	0	
Site 7	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	0	
Site 8	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	1	
Site 9	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
Initials		DP	DP	DP	DP	DP	DP	DP	DP	DP	DP	DP	DP	DP	DP	DP		
Date		9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	11/1	

Key: D=dead, N=normal activity, A=abnormal activity B=no observations P=pupae F=fly

Comments:

① 2 OLIGOCHAETES SC. 5D. 5E 09/20/03 ② TOTAL EMERGENT ADULTS AT END OF 14 DAY EXP 14-28 DAYS 9/11/03
25 PRESENT 6A. 6C

THRU
28

Job Number: 173-01-01
 Species: C. tentans

Hat

Beginning Date & Time: 9-3-03 1840
 Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

Conc.	Rep.	Day															Day 28	
		14	15	16	17	18	19	20	21	22	23	24	25	26	27	Observ	Final Count	①
Site 10	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
/	A																	
	B																	
	C																	
	D																	
	E																	
/	A																	
	B																	
	C																	
	D																	
	E																	
/	A																	
	B																	
	C																	
	D																	
	E																	
/	A																	
	B																	
	C																	
	D																	
	E																	
Initials		TAP	TAP	TAP	TAP	JF	TAP	TAP	TAP	MP	MP	MP	MP	TAP	MP	TAP		
Date		9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1		

Key: D=dead, N=normal activity, A=abnormal activity B=no observations

Comments:

① TOTAL EMERGENT ADULTS AT END OF 14 DAY EXP. 14-28 DAYS 9/11/03

TAPU
28

Job Number: 173-01-01
Species: C. tentans

Hatch

Beginning Date & Time: 9-3-03 1840
Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
American Aquatic Testing, Inc.,
Observations/Live Count

		Day														
Conc.	Rep.	29	30	31	32	33	34	35	36	37	38	39	40	41	42	
Control	A	IF	2F	IF	IF	D	B	IF	B	B	B	B	B	IF	B	7
	B	NO	IF	IF	IF	B	2F	B	B	B	B	B	B	IF	B	6
	C	IF	B	IF	IF	IF	B	B	B	B	B	B	B	B	B	4
	D	IF	B	B	B	B	IF	B	2F	B	B	B	B	IF	B	5
	E	NO	B	IF	B	B	B	IF	B	IF	IF	B	IF	B	B	5/27
Site 1	A	B	B	IF	B	B	B	B	IF	B	B	B	B	B	B	2
	B	B	B	IF	B	B	B	B	B	B	IF	IF	B	B	B	2
	C	B	B	B	B	B	B	B	B	IF	B	B	B	B	B	3
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B	4/7
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B	5
Site 2	A	B	B	B	B	B	B	IF	B	IF	IF	B	B	B	B	2
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	2
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	2
	D	B	B	B	B	B	B	B	B	B	B	B	B	IF	B	3/12
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B	1
Site 3	A	B	B	B	B	IF	B	B	B	B	B	B	B	B	B	4
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	4
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	4
	D	B	B	B	B	B	B	B	B	B	B	B	B	IF	B	1/2
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B	1
Site 4	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	2
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	1
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	1
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B	4
	E	B	B	B	B	B	B	B	B	2F	IF	B	B	B	B	3/9
Initials		TP	PS	TP	TP	PS	PS	IF	NO	NO	IF	IF	NO	PS	IF	9/14
Date		10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations F-Fly

Comments: ① B

- ② 2 large unidentified flies emerged > ALL IDENTIFIED AS C. tentans
③ 1 large unidentified fly emerged 10/10/03
④ TOTAL EMERGENT ADULTS AT END OF 14 DAY PERIOD 29-42 DAYS 11/11/03

THRU
42

Job Number: 173-01-01
Species: C. tentans

Beginning Date & Time: 9-3-03 1840
Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
American Aquatic Testing, Inc.,
Observations/Live Count

Conc.	Rep.	Day														
		29	30	31	32	33	34	35	36	37	38	39	40	41	42	
Site 5	A	B	B	B	B	B	B	B	2F	B	B	B	B	B	B	2
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	0
	C	B	B	B	B	B	B	B	IF	B	B	B	B	B	B	1
	D	B	B	B	B	IF	B	B	B	B	B	B	B	B	B	1
	E	B	B	B	B	B	IF	B	B	IF	B	B	B	B	IF	3/19
Site 6	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	0
	B	B	B	B	B	IF	B	B	IF	B	IF	IF	B	B	IF	5
	C	B	B	B	B	B	IF	B	B	B	IF	IF	B	IF	B	6
	D	B	B	B	IF	B	B	B	IF	IF	IF	IF	B	B	B	6
	E	B	B	B	B	B	B	B	B	B	IF	B	B	IF	B	2/19
Site 7	A	B	IF	IF	B	B	B	IF	B	IF	B	B	B	B	B	4
	B	B	IF	B	B	B	B	B	B	B	IF	B	B	B	B	2
	C	B	B	B	B	B	B	B	IF	B	B	B	B	IF	IF	3
	D	B	B	B	B	IF	IF	B	B	B	B	B	IF	B	B	3
	E	B	B	B	IF	B	B	B	B	B	IF	IF	2F	B	B	5/17
Site 8	A	B	B	B	IF	B	IF	B	IF	B	B	B	B	IF	B	4
	B	B	B	B	B	IF	B	B	B	B	IF	B	IF	2F	B	5
	C	B	B	B	IF	IF	B	B	B	IF	B	B	B	B	B	6
	D	B	B	B	IF	IF	IF	B	2F	B	2F	B	B	B	B	7
	E	B	B	B	B	IF	B	3F	IF	B	IF	B	B	B	B	6/22
Site 9	A	B	B	B	B	IF	B	B	B	B	B	IF	B	IF	B	3
	B	IF	B	B	B	IF	IF	B	IF	B	IF	B	IF	B	B	6
	C	B	B	B	B	IF	B	IF	IF	B	IF	B	B	B	B	4
	D	B	IF	B	B	B	B	IF	B	B	B	2F	IF	IF	B	5
	E	B	IF	B	IF	B	IF	IF	B	B	IF	B	B	B	B	5/23
Initials		TP	TP	TP	TP	TP	TP	TP	TP	TP	TP	TP	TP	TP	TP	TP
Date		10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	11/4

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations F=F/L

Comments: ① large unidentified fly emerged

② IF 2F 10/10

③ 3F IF 10/11

④ TOTAL EMERGENT ADULTS AT END OF 14 DAY PERIOD 29-42 DAYS 11/10/03

THRU
42

Hatch

Beginning Date & Time: 9-3-03 184
Ending Date & Time: 11-07-03 1200Job Number: 173-01-01
Species: C. tentansFreshwater Sediment Test
American Aquatic Testing, Inc.,
Observations/Live Count

		Day														①
Conc.	Rep.	29	30	31	32	33	34	35	36	37	38	39	40	41	42	
Site 10	A	B	B	B	B	B	B	IF	B	IF	B	B	B	B	IF	3
	B	B	B	B	B	IF	B	B	B	B	B	B	B	IF	B	2
	C	B	B	B	B	B	IF	IF	IF	B	B	B	B	B	B	3
	D	IF	B	B	B	B	B	B	B	B	B	B	B	B	IF	2
	E	B	B	B	B	B	B	IF	B	B	B	B	B	B	B	1/11
	A															
	B															
	C															
	D															
	E															
	A															
	B															
	C															
	D															
	E															
	A															
	B															
	C															
	D															
	E															
	A															
	B															
	C															
	D															
	E															
Initials		9/2	9/2	TOP	TOP	2D	2D	IF	NP	NP	IF	IF	NP	TOP	IF	9/4
Date		10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations F=Fly

Comments:

~~① large unidentified fly emerged~~
 ① TOTAL EMERGENT ADULTS AT END OF 14 DAY PERIOD 29-42 DAYS 9/4/03

THRU
42

Hatch

Job Number: 173-01-01

Species: *D. tentans*

Beginning Date & Time: 9-3-03 1848

Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
American Aquatic Testing, Inc.,
Observations/Live Count

		Day														51/56	
Conc.	Rep.	43	44	45	46	47	48	49	50	51	52	53	54	55	56	51	56
Control	A	1F	Final Count - 2														
	B	B	Final Count - 6														
	C	B	Final Count - 5														
	D	1F	Final Count - 3, 1P														
	E	1F	Final Count - 4														
Site 1	A	2F	B	B	1F	1F	B	B	1F	B	1F	B	B	B	B	5	6
	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	1	2
	C	B	1F	B	B	B	B	B	B	B	1F	B	B	B	B	2	2
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B	0/6	0/8
	E	B	B	B	B	B	B	B	B	B	B	B	B	B	B	0/6	0/8
Site 2	A	1F	B	B	B	B	B	B	1F	B	B	B	B	B	B	2	2
	B	1F	1F	B	1F	B	B	B	B	B	B	B	B	B	B	3	3
	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	0	0
	D	B	B	1F	B	B	B	2F	B	B	B	B	B	B	B	3	3
	E	B	B	1F	B	B	B	B	B	B	1F	B	B	B	1F	1/9	3/11
Site 3	A	B	B	B	B	B	B	B	Final Count - 4							0	0
	B	B	B	B	B	B	B	B	Final Count - 8							0	0
	C	B	B	B	B	B	B	B	Final Count - 8							0	0
	D	B	B	B	B	B	B	B	Final Count - 5							0	0
	E	B	B	B	B	B	B	B	Final Count - 2							0	0
Site 4	A	B	1F	B	B	B	B	B	B	B	B	10	Final Count - 0			1	1
	B	1F	B	B	B	B	B	B	B	B	B	B	Final Count - 0			1	1
	C	B	B	1F	B	B	B	B	B	B	B	B	Final Count - 0			1	1
	D	B	B	B	B	B	B	B	B	B	B	B	Final Count - 1			0	0
	E	1F	B	B	B	1F	B	B	B	B	B	B	Final Count - 0			2/5	2/5
Initials		MP	JP	OT	RD	RD	RD	JP	MP	RD	JP	OT	RD	MP	JP	OT	11/11
Date		10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29		

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations F=Fly P=pupae

Comments: ① Found unidentified nymph. im 10/16

② UNSUCCESSFUL EMERGENT ADULT 10/16/03

③ CONTROLS ENDED @ 44 DAYS: 50% HATCH OF ORIGINAL 60 TEST ORGANISMS 10/16/03

FINAL SURVIVOR RATE (ALL INCL) 83.3%

④ SITE 3 ENDED: 7 DAYS AFTER CON. - NO ADD'L EMERGENCE 50% HATCH. FINAL SURV (ALL INCL) 50% 10/23/03

⑤ SITE 4 ENDED: 10 DAYS AFTER CON. - NO ADD'L EMERGENCE 20% HATCH FINAL SURV (ALL INCL) 21.7% 10/27/03

⑥ TOTAL EMERGENT ADULTS AT DAY 58 (CONTROL + 7D) + DAY 56 11/11/03

THRU
56

Job Number: 173-01-01
Species: C. tentans

Beginning Date & Time: 9-3-03 184
Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
American Aquatic Testing, Inc.,
Observations/Live Count

		Day <u>(3)</u>														51 56	
Conc.	Rep.	43	44	45	46	47	48	49	50	51	52	53	54	55	56		
Site 5	A	0 F	B	B	B	B	B	B	Final Count - 7							3	3
	B	B	B	B	B	B	B	B	Final Count - 10							0	0
	C	B	B	B	B	B	B	B	Final Count - 8							0	0
	D	B	B	B	B	B	B	B	Final Count - 11							0	0
	E	B	B	B	B	B	B	B	Final Count - 3							0/3	0/3
Site 6	A	1 F	B	B	B	B	1 F	B	B	B	12	B	1 F	B		2	3
	B	B	B	B	B	B	B	B	B	B	B	B	B	B		6	2
	C	B	B	B	B	B	1 F	1 F	1 F	B	B	B	B	B		3	3
	D	B	B	B	B	B	B	1 F	1 F	1 F	B	B	B	B		3	3
	E	B	1 F	B	B	B	1 F	B	B	B	1 F	2 F	2 F	B	1 F	2/10	8/19
Site 7	A	B	B	B	B	B	B	B	B	B	B	B	B	B		0	0
	B	B	B	1 F	B	B	B	B	B	B	B	B	B	B		1	1
	C	B	B	1 F	1 F	B	B	3 F	1 F	B	B	B	B	B		6	6
	D	B	B	B	B	B	B	B	B	1 F	B	B	B	1 F	B	1	2
	E	B	B	B	B	B	B	B	B	B	B	B	B	B		0/8	0/9
Site 8	A	B	B	B	B	B	1 F	B	B	B	2 F	B	B	B		1	3
	B	B	B	B	B	B	B	B	B	B	B	B	B	B		0	0
	C	B	B	B	B	B	B	B	B	2 F	B	B	1 F	B		2	3
	D	B	B	1 F	B	B	B	1 F	B	B	B	B	B	B		2	2
	E	B	B	B	1 F	B	B	1 F	1 F	B	B	B	B	B		3/8	3/11
Site 9	A	B	B	B	B	B	1 F	B	1 F	B	B	B	B	B		2	2
	B	1 F	B	B	2 F	B	B	B	1 F	B	B	B	B	B		4	4
	C	B	1 F	B	B	B	B	B	1 F	B	B	1 F	1 F	B		2	4
	D	B	B	B	B	B	B	B	B	B	B	B	1 F	B		0	1
	E	B	B	B	B	B	B	B	1 F	1 F	2 F	B	B	B		2/10	4/15
Initials		MD	JF	MD	MD	MD	JF	MD	MD	MD	MD	MD	MD	MD			
Date		10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29		

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations F=Fly

Comments: ① 3 MP 10/16

② UNSUCCESSFUL EMERGENT ADULT 10/26

③ SITE 5 ENDED; 7 DAYS AFTER CON - NO ADD'L EMERGENCE. 16.7% HATCH FINAL SURV (ALL INCL) 81.7% 10/24/03

④ TOTAL EMERGENT ADULTS AT DAY 51 (CONTROL + 7D) + DAY 56 11/1/03

THRU
56

Job Number: 173-01-01
Species: C. tentans

Beginning Date & Time: 9-3-03 184
Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
American Aquatic Testing, Inc.,
Observations/Live Count

		Day														(2)	
Conc.	Rep.	43	44	45	46	47	48	49	50	51	52	53	54	55	56	51	56
Site 10	A	1F	B	B	B	B	B	B	B	B	B	B	B	B	B	1	1
	B	1F	B	B	B	1F	1F	B	1F	B	B	B	B	B	B	4	4
	C	B	B	B	B	B	B	B ①	B	B	B	B	B	B	B	1	1
	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B	φ	φ
	E	2F	B	B	B	B	B	2F	B	B	B	B	B	B	B	4	4
	A																
	B																
	C																
	D																
	E																
	A																
	B																
	C																
	D																
	E																
	A																
	B																
	C																
	D																
	E																
	A																
	B																
	C																
	D																
	E																
Initials		MP	TF	1/	MD	MD	9D	TF	MP	MD	1/	MP	MP	MP	9D	1/11	
Date		10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29		

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations F=Fly

Comments:

① 1F MP 10/22
② TOTAL EMERGENT ADULTS AT DAY 51 (CONTROL + TD) + DAY 56 11/1/03

THAO
56

Job Number: 173-01-01
Species: C. tentans

Beginning Date & Time: 9-3-03 1840
Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
American Aquatic Testing, Inc.,
Observations/Live Count

Conc.	Rep.	57	58	59	60	61	62	63	64	65	58	65
Site 1	A	B	B	Final Count - 0							0	0
	B	B	B	Final Count - 0							0	0
	C	B	B	Final Count - 0							0	0
	D	B	B	Final Count - 0							0	0
	E	B	B	Final Count - 0							0	0
Site 2	A	B	B	B	B	B	B	FINAL COUNT 0			0	0
	B	B	B	B	B	B	B	FINAL COUNT 1L			0	0
	C	B	B	B	B	B	B	FINAL COUNT 0			0	0
	D	B	B	B	B	B	B	FINAL COUNT 0			0	0
	E	B	B	B	B	B	B	FINAL COUNT 0			0	0
Site 6	A	B	B	B	B	B	IF	IF	FINAL COUNT - 3		0	2
	B	B	B	IF	B	B	B	B	Final Count - 0		0	1
	C	B	2F	B	B	B	B	B	Final Count - 1		2	2
	D	B	B	B	B	B	B	B	Final Count - 0		0	0
	E	IF	B	IF	B	B	B	B	Final Count - 0		1/3	2/7
Site 7	A	B	B	B	B	B	B	B	Final Count - 0		0	0
	B	B	B	B	B	B	B	B	Final Count - 0		0	0
	C	B	IF	B	B	B	B	B	Final Count - 0		1	1
	D	B	B	B	B	B	B	B	Final Count - 0		0	0
	E	B	IF	B	B	B	B	B	Final Count - 0		1/2	1/2
Site 8	A	B	B	B	B	Final Count - 0					0	0
	B	B	B	B	B	Final Count - 0					0	0
	C	B	B	B	B	Final Count - 1P					0	0
	D	B	B	B	B	Final Count - 0					0	0
	E	B	B	B	B	Final Count - 1					0	0
Initials		MD	JH	WXP	JL	MD	MD	MD	MD	TAP		
Date		10/30	10/31	11/01	11/2	11/3	11/4	11/5	11/6	11/7		4/4

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations F=Fly P=pupae

Comments:

- ① SITE 1 ENDED @ 15 DAYS AFTER CON. NO ADD'L EMERGENCE. 25% HATCH. FINAL SURV (ALL INCL.) 25% 11/6/03
② SITE 2 ENDED @ 19 DAYS AFTER CON. NO ADD'L EMERGENCE. 38.3% HATCH. FINAL SURV (ALL INCL.) 40% 11/05/03
③ SITE 8 ENDED @ 17 DAYS AFTER CON. NO ADD'L EMERGENCE. 65% HATCH. FINAL SURV (ALL INCL.) 68.3% 11/03/03
④ SITE 6 ENDED @ 21 DAYS AFTER CON. CON. + 21 DAYS REACHED 75% HATCH. FINAL SURV (ALL INCL.) 81.7% 11/08/03
⑤ SITE 7 ENDED @ 21 DAYS AFTER CON. CON. + 21 DAYS REACHED 46.7% HATCH. FINAL SURV (ALL INCL.) 46.7% 11/09/03

TAPU
65

Job Number: 173-01-01
 Species: C. tentans

Beginning Date & Time: 9-3-03 1840
 Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Observations/Live Count

①											Day		②										
Conc.	Rep.	57	58	59	60	61	62	63	64	65													
Site 9	A	B	B	IF	IF	B	B	B	B	Final Count - 2													
	B	B	B	B	B	B	B	B	B	Final Count - 0													
	C	B	B	B	B	B	B	B	B	Final Count - 0													
	D	B	B	B	B	B	B	B	B	Final Count - 3													
	E	B	B	B	B	B	IF	B	B	Final Count - 0													
Site 10	A	Final Count - 1, 1 Pupa																					
	B	Final Count - 2																					
	C	Final Count - 2, 1P																					
	D	Final Count - 4																					
	E	Final Count - 1																					
	A																						
	B																						
	C																						
	D																						
	E																						
	A																						
	B																						
	C																						
	D																						
	E																						
	A																						
	B																						
	C																						
	D																						
	E																						
Initials		JL	JL	WP	JF	JL	JL	JL	JL	JL													
Date		10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7													

Key: D=dead, N=normal activity, A=abnormal activity, B=No Observations F=Fly P=pupa

Comments:

① SITE 10 ENDED @ 13 DAYS AFTER CON. NO ADDL EMERGENCE. 28.3% HATCH FINAL SURV (ALL INCL) 46.7% 11/30/03
 ② SITE 9 ENDED @ 21 DAYS AFTER CON. CON + 21 DAYS REACHED. 70% HATCH

TARU
65

Job Number: 173-01-01
Species: C. tentans

Hatch

Start Date & Time: 9-3-03
End Date & Time: 11-07-03 12:00

Sediment Test
American Aquatic Testing, Inc.,
Water Change Log/Initial Water Readings/General Testing Information

Test Day	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Morning change(time)	0930	0950	1020	0930	0900	0920	0910	0800	0745	0830	0700	1000	0730	0800	0745
D.O. mg/L	7.6	7.5	8.0	7.7	8.5	7.2	8.4	8.4	8.7	8.6	8.4	8.2	8.2	8.6	8.5
pH	7.4	8.0	7.9	7.9	8.3	7.8	8.2	8.2	8.2	8.4	8.1	8.0	8.1	8.1	8.2
Temp. (C)	24.0	24.0	24.0	23.0	22.5	23.0	22.0	22.5	22.5	23.0	23.0	22.5	22.5	22.5	22.5
Initials	MP	MP	MP	JF	JF	MP	MP	JF	JF	JF	MP	MP	JF	JF	JF
Date	9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17
Afternoon change(time)	1725	1730	1700	1850	1630	1630	1610	1610	1610	1700	1730	1730	1800	1710	1800
D.O. mg/L	7.6	7.6	8.3	8.5	8.7	7.9	8.4	8.2	8.2	8.5	8.2	8.1	8.1	8.0	8.4
pH	7.6	7.9	7.6	8.3	8.3	7.8	7.6	7.6	7.6	8.1	7.9	7.9	7.9	7.9	8.0
Temp. (C)	23.5	22.5	22.0	22.0	22.0	23.0	22.0	22.5	22.5	22.5	22.5	23.5	22.0	23.5	23.0
Initials	JF	MP	JF	JF	JF	JF	JF	JF	JF	JF	MP	MP	JF	JF	MP
Date	9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17

Test Day	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Morning change(time)	0730	0900	0920	0900	0745	0930	1030	0800	0830	0830	1000	1000	0800	0900
D.O. mg/L	8.2	8.6	8.3	8.4	7.7	8.0	8.0	8.8	8.8	8.8	8.8	8.4	8.3	8.0
pH	8.2	8.2	8.1	8.2	8.0	7.9	7.4	7.6	7.6	7.6	7.7	7.4	8.1	7.9
Temp. (C)	22.5	22.0	22.5	22.0	22.5	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Initials	JF	JF	JF	JF	JF	JF	JF	JF	JF	MP	MP	MP	JF	MP
Date	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1
Afternoon change(time)	1700	1800	1830	1800	1700	2200	1630	1730	1800	2000	1600	1730	1800	1946
D.O. mg/L	8.2	8.9	8.2	8.1	7.9	7.9	7.7	8.3	8.7	8.7	8.8	8.5	7.8	8.1
pH	7.8	7.7	7.9	7.8	8.0	7.9	7.7	7.9	7.7	7.6	7.7	7.6	7.8	8.0
Temp. (C)	23.0	22.0	23.0	22.0	22.0	22.0	24.0	22.0	22.0	22.0	22.0	22.0	22.0	24.0
Initials	JF	JF	JF	JF	JF	MP	JF	MP	MP	JF	MP	MP	MP	JF
Date	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1

Control Sed. collection date/by: 8-26-03/MP Organism source: ABS Inc.

Test Chamber size: 300 ml

Control Sed. sieve date/by: 8-26-03/JF Test organism Lot number: 640

Test Volume of sediment: 100 ml

Sieve size used: 18

Number of animals per chamber: 12

Test Volume of water: 175 ml

Sample sieve date/by: N/A

Food Type: Tetramin slurry

Test Duration: 65 DAYS

Sieve size used: N/A

Frequency of feeding: 1x a day

Test Temperature Range: 23 ± 1 °C

Job Number: 173-01-01
Species: C. tentans

Start Date & Time: 9-3-03 1800
End Date & Time: 11-07-03 1200

179707
Sediment Test
American Aquatic Testing, Inc.,
Water Change Log/Initial Water Readings/General Testing Information

Test Day	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
Morning change(time)	0730	1000	0900	800	945	0730	1000	1000	0930	1100	0845	0950	0830	0930	1010
D.O. mg/L	7.9	8.0	7.9	8.1	8.5	8.4	8.4	8.5	8.4	8.6	7.7	8.3	8.1	7.9	8.0
pH	8.5	8.5	8.2	8.0	7.8	7.8	7.7	8.0	8.0	8.1	7.9	8.4	8.2	8.0	7.9
Temp. (C)	22.0	22.0	22.5	22.5	22.5	22.5	22.0	23.0	23.0	22.0	22.0	22.5	22.5	22.0	22.5
Initials	JF	MP	MP	MP	MP	JF	MP	JF	JF	JF	JF	MP	MP	MP	MP
Date	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16
Afternoon change(time)	1750	1700	1800	1500	1725	1650	1900	1720	1740	1800	1400	1650	1815	1740	1700
D.O. mg/L	7.8	7.8	8.2	8.3	8.3	8.4	8.6	8.5	8.5	8.5	7.9	8.3	7.9	8.2	8.1
pH	8.6	7.8	8.1	8.0	7.7	7.7	8.0	7.9	8.0	8.0	7.9	8.5	7.9	8.0	8.0
Temp. (C)	22.5	22.0	22.5	22.5	22.0	22.0	22.0	22.0	23.0	23.0	22.0	22.0	22.0	22.0	22.0
Initials	MP	MP	MP	MP	MP	JF	MP	MP	MP	JF	JF	MP	MP	MP	MP
Date	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16

Test Day	44	45	46	47	48	49	50	51	52	53	54	55	56	57
Morning change(time)	0800	0930	1030	1100	1015	1030	1000	0930	1030	1045	1030	1000	0930	1000
D.O. mg/L	8.0	7.8	7.5	8.1	6.5	7.2	8.1	8.0	7.9	7.8	7.9	7.8	8.6	7.7
pH	7.9	7.8	8.1	8.1	8.1	8.0	7.7	8.1	8.0	8.1	8.0	7.9	8.0	8.1
Temp. (C)	22.0	22.0	22.0	21.5	24.0	22.0	22.0	22.0	22.0	23.0	23.5	23.0	22.5	22.0
Initials	JF	MP	MP	MP	MP	MP	MP	JF	JF	JF	MP	MP	MP	MP
Date	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30
Afternoon change(time)	1700	1930	1730	1650	1700	1830	1650	1630	1715	1900	1700	1700	1700	1620
D.O. mg/L	8.0	7.8	8.3	8.0	8.1	7.1	7.9	8.6	7.9	7.9	7.7	7.8	7.7	8.1
pH	7.9	8.1	8.3	7.9	8.1	8.2	8.0	7.6	7.9	8.0	7.8	8.0	8.3	8.0
Temp. (C)	22.0	22.5	22.0	22.0	24.0	22.0	22.0	22.0	22.0	23.0	23.0	23.0	23.0	23.0
Initials	JF	MP	MP	MP	MP	MP	MP	JF	JF	JF	MP	MP	MP	MP
Date	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30

① 8.1 - 9.2 - 10/21

Control Sed. collection date/by: _____ Organism source: _____ Test Chamber size: _____
Control Sed. sieve date/by: _____ Test organism Lot number: _____ Test Volume of sediment: _____
Sieve size used: _____ Number of animals per chamber: _____ Test Volume of water: _____
Sample sieve date/by: _____ Food Type: _____ Test Duration: _____
Sieve size used: _____ Frequency of feeding: _____ Test Temperature Range: _____

Job Number: 173-01-01
Species: C. tentans

Start Date & Time: 9-3-03 1800
End Date & Time: 11-07-03 1200

Sediment Test
American Aquatic Testing, Inc.,
Water Change Log/Initial Water Readings/General Testing Information

Test Day	58	59	60	61	62	63	64	65										
Morning change(time)	0945	1040	1100	0930	0940	0730	0930											
D.O. mg/L	8.1	8.0	8.0	8.0	8.2	8.2	8.2											
pH	7.6	7.7	7.5	7.6	8.0	8.0	8.0											
Temp. (C)	22.0	23.5	22.5	22.0	23.0	22.5	23.0											
Initials	JF	JP	JK	JP	JD	JF	JD											
Date	10/31	11/1	11/2	11/3	11/4	11/5	11/6											
Afternoon change(time)	1630	1700	1600	1550	1630	1610	1710											
D.O. mg/L	8.1	8.0	8.0	8.1	8.3	8.1	8.0											
pH	7.6	7.6	7.5	8.0	8.0	8.1	7.9											
Temp. (C)	22.0	22.0	22.0	23.0	24.0	23.0	23.0											
Initials	JF	JP	JF	JD	JD	JD	JD											
Date	10/31	11/1	11/2	11/3	11/4	11/5	11/6											

Test Day																		
Morning change(time)																		
D.O. mg/L																		
pH																		
Temp. (C)																		
Initials																		
Date																		
Afternoon change(time)																		
D.O. mg/L																		
pH																		
Temp. (C)																		
Initials																		
Date																		

Control Sed. collection date/by: _____ Organism source: _____ Test Chamber size: _____
Control Sed. sieve date/by: _____ Test organism Lot number: _____ Test Volume of sediment: _____
Sieve size used: _____ Number of animals per chamber: _____ Test Votafine of water: _____
Sample sieve date/by: _____ Food Type: _____ Test Duration: _____
Sieve size used: _____ Frequency of feeding: _____ Test Temperature Range: _____

Client/Toxicant: 173
 Job Number: 01-01
 Species: C. tentans

Hatch

Beginning Date & Time: 9-3-03 1840
 Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Physical / Chemical Parameters

Parameter	Concentration	Day											
		0	1	2	3	4	5	6	7	8	9	10	
TEMP (C)	Control	23.0	22.5	22.0	22.0	22.0	22.5	22.5	22.0	22.5	22.0	22.0	
	Site 1	23.0	22.5	22.0	22.0	22.0	22.5	22.5	22.0	22.5	22.0	22.0	
	Site 2	23.0	22.0	22.0	22.0	22.0	22.0	22.5	22.0	22.0	22.0	22.0	
	Site 3	23.0	22.0	22.0	22.0	22.0	22.0	22.5	22.0	22.0	22.0	22.0	
	Site 4	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	
	Site 5	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	
	Site 6	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	
	Site 7	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	
	Site 8	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	
	Site 9	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	
	Site 10	23.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	
Dissolved Oxygen (mg/L)	Control	6.3	6.6	7.0	6.7	7.0	6.1	7.4	6.6	6.3	7.3	6.7	
	Site 1	6.9	6.8	7.4	7.1	7.7	6.8	7.3	7.1	7.1	7.3	7.0	
	Site 2	6.9	6.9	7.5	7.2	7.5	6.7	7.5	7.0	6.8	7.5	7.1	
	Site 3	4.4	6.1	6.3	6.4	6.7	5.8	6.2	6.4	5.5	6.6	5.9	
	Site 4	5.0	6.3	6.8	6.9	7.3	6.5	7.0	6.6	6.4	7.3	7.0	
	Site 5	5.3	6.3	6.8	6.6	7.3	6.5	6.9	6.4	6.3	7.3	7.0	
	Site 6	5.8	6.5	6.8	6.7	7.3	6.4	6.9	6.8	6.5	7.3	7.0	
	Site 7	3.2	6.6	7.0	6.8	7.2	6.5	6.9	6.7	6.8	7.3	7.0	
	Site 8	5.5	6.6	6.8	6.9	7.1	6.4	7.0	6.8	6.3	7.3	7.0	
	Site 9	5.0	6.5	6.8	6.8	7.1	6.4	6.9	6.7	6.2	7.3	6.9	
	Site 10	5.5	6.6	7.0	6.6	7.5	6.3	7.2	6.7	6.5	7.2	6.9	
pH	Control	7.2	7.2	7.7	7.7	7.7	7.6	7.8	7.7	7.6	8.0	7.8	
	Site 1	7.2	7.2	7.8	7.7	7.8	7.6	7.7	7.7	7.7	8.0	7.9	
	Site 2	7.2	7.2	7.8	7.7	7.8	7.6	7.5	7.6	7.6	7.8	7.8	
	Site 3	7.2	7.3	7.7	7.7	7.7	7.5	7.5	7.5	7.5	7.8	7.8	
	Site 4	7.0	7.2	7.7	7.6	7.7	7.5	7.5	7.5	7.5	7.8	7.8	
	Site 5	7.1	7.2	7.7	7.6	7.7	7.5	7.5	7.5	7.5	7.8	7.8	
	Site 6	7.2	7.3	7.8	7.6	7.7	7.5	7.5	7.5	7.6	7.8	7.8	
	Site 7	7.1	7.4	7.8	7.6	7.8	7.5	7.5	7.6	7.6	7.9	7.8	
	Site 8	7.2	7.4	7.8	7.6	7.8	7.6	7.6	7.6	7.6	7.8	7.8	
	Site 9	7.2	7.4	7.7	7.7	7.8	7.6	7.6	7.6	7.6	7.8	7.8	
	Site 10	7.2	7.4	7.7	7.7	7.8	7.5	7.5	7.6	7.6	7.8	7.8	
Initials		AD	AD	NP	JF	JF	AD	AD	NP	AD	NP	NP	
Date		9/3	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	

Concentration	Cond. (umhos)		Alkalinity (mg/L)		Hardness (mg/L)		Ammonia (mg/L)		Comments: ① Day 7 ② - 6.6 - 9.2 - 9/8 ③ - 7.6 - 9.2 - 9/8
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
Control	275	275	60	60	80	70	0.04	0.00	
Site 1	275	275	70	70	70	80	0.00	0.00	
Site 2	275	275	70	70	80	90	0.00	0.00	
Site 3	275	270	60	60	80	90	0.10	0.01	
Site 4	275	275	60	70	80	90	0.00	0.03	
Site 5	280	280	70	60	70	80	0.13	0.00	
Site 6	270	270	60	70	70	80	0.13	0.00	
Site 7	280	270	70	70	80	90	0.16	0.01	
Site 8	280	270	70	70	80	90	0.15	0.01	
Site 9	280	270	70	70	80	90	0.23	0.01	
Site 10	270	280	50	40	80	70	0.09	0.00	
Initials	AD	NP	AD	NP	AD	NP	AD	NP	
Date	9/3	9/10	9/3	11/7	9/3	11/7	9/3	11/7	

Hatch

Client/Toxicant: 173
 Job Number: 01-01
 Species: C. tentan

Beginning Date & Time: 9-3-03 1840
 Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Physical / Chemical Parameters

Parameter	Concentration	Day										
		11	12	13	14	15	16	17	18	19	20	21
TEMP (C)	Control	23.0	22.0	22.5	22.0	22.5	22.5	23.0	22.5	23.0	22.5	23.0
	Site 1	23.0	22.0	22.5	22.0	22.5	22.5	23.0	22.0	23.0	22.5	23.0
	Site 2	23.0	22.0	22.5	22.0	22.5	22.5	23.0	22.0	23.0	22.0	23.0
	Site 3	23.0	22.0	22.5	22.0	22.5	22.5	23.0	22.0	23.0	22.0	23.0
	Site 4	23.0	22.0	22.5	22.0	22.5	22.5	23.0	22.0	23.0	22.0	23.0
	Site 5	23.0	22.0	22.5	22.0	22.5	22.5	23.0	22.0	23.0	22.0	23.0
	Site 6	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.5	23.0	22.0	23.0
	Site 7	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.0	23.0	22.0	23.0
	Site 8	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.0	23.0	22.0	23.0
	Site 9	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.0	23.0	22.0	23.0
	Site 10	23.0	22.0	22.5	22.0	22.5	22.0	23.0	22.0	23.0	22.0	23.0
Dissolved Oxygen (mg/L)	Control	6.8	6.8	6.5	6.7	6.8	6.5	6.8	5.9	6.0	6.3	6.8
	Site 1	7.3	7.1	6.8	6.9	6.9	7.2	7.0	6.3	6.4	6.1	6.5
	Site 2	7.2	7.0	7.0	7.2	7.0	7.1	7.0	5.3	6.5	6.0	6.4
	Site 3	5.8	5.5	5.1	5.6	5.9	5.1	5.2	4.0	4.3	4.7	5.3
	Site 4	7.2	6.8	6.5	6.9	6.8	6.9	6.9	4.0	5.5	5.5	5.9
	Site 5	7.0	5.8	5.3	6.4	6.7	5.4	5.8	6.0	4.8	5.9	6.0
	Site 6	7.0	6.6	6.0	6.8	6.8	5.6	5.9	5.6	4.6	6.0	6.4
	Site 7	7.0	6.4	6.2	6.6	6.8	6.2	6.5	5.6	5.3	5.8	5.8
	Site 8	6.9	6.5	6.1	6.5	6.7	6.1	6.4	6.1	4.5	5.4	5.9
	Site 9	7.0	6.7	6.0	6.5	6.7	6.8	6.9	5.4	4.9	5.9	6.2
	Site 10	7.0	6.8	6.6	6.7	6.9	7.3	7.0	6.4	6.1	5.9	6.4
pH	Control	7.9	7.5	7.5	7.6	7.7	7.7	7.8	7.7	7.6	7.6	7.8
	Site 1	7.9	7.5	7.5	7.6	7.8	7.7	7.8	7.7	7.5	7.6	7.8
	Site 2	7.8	7.5	7.5	7.6	7.8	7.7	7.8	7.7	7.5	7.5	7.6
	Site 3	7.7	7.5	7.3	7.4	7.5	7.7	7.8	7.6	7.4	7.6	7.5
	Site 4	7.8	7.5	7.3	7.5	7.7	7.7	7.8	7.6	7.4	7.6	7.6
	Site 5	7.8	7.4	7.3	7.6	7.7	7.6	7.8	7.5	7.3	7.5	7.6
	Site 6	7.8	7.4	7.3	7.6	7.8	7.6	7.7	7.5	7.3	7.5	7.6
	Site 7	7.8	7.6	7.5	7.7	7.8	7.9	7.8	7.6	7.5	7.4	7.7
	Site 8	7.8	7.6	7.5	7.7	7.8	7.9	7.8	7.6	7.5	7.4	7.6
	Site 9	7.8	7.5	7.5	7.7	7.8	7.8	7.8	7.6	7.5	7.4	7.5
	Site 10	7.8	7.5	7.5	7.7	7.8	7.7	7.8	7.6	7.5	7.4	7.6
Initials		MP	MP	MP	MP	MP	MP	MP	MP	MP	MP	MP
Date		9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24

Concentration	Cond. (umhos)		Alkalinity (mg/L)		Hardness (mg/L)		Ammonia (mg/L)		Comments: ① Day 14 ② Day 21
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
Control	280	275							
Site 1	275	260							
Site 2	275	270							
Site 3	270	280							
Site 4	280	280							
Site 5	270	280							
Site 6	270	280							
Site 7	275	285							
Site 8	280	290							
Site 9	275	280							
Site 10	275	280							
Initials	MP	MP							
Date	9/17	9/21							

Hatch

Client/Toxicant: 173
 Job Number: 01-01
 Species: C. tentans

Beginning Date & Time: 9-3-03 1840
 Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Physical / Chemical Parameters

Parameter	Concentration	Day										
		22	23	24	25	26	27	28	29	30	31	32
TEMP (C)	Control	22.0	22.0	22.0	22.0	23.0	23.0	22.5	23.0	22.0	22.5	22.5
	Site 1	22.0	22.0	22.0	22.0	23.0	23.0	22.5	23.0	22.0	22.5	22.5
	Site 2	22.0	22.0	22.0	22.0	23.0	23.0	22.5	23.0	22.0	22.5	22.5
	Site 3	22.0	22.0	22.0	22.0	23.0	23.0	22.5	23.0	22.0	22.5	22.5
	Site 4	22.0	22.0	22.0	22.0	23.0	23.0	22.5	23.0	22.0	22.5	22.5
	Site 5	22.0	22.0	22.0	22.0	23.0	23.0	22.5	23.0	22.0	22.5	22.5
	Site 6	22.0	22.0	22.0	22.0	23.0	23.0	22.5	23.0	22.0	22.5	22.5
	Site 7	22.0	22.0	22.0	22.0	23.0	23.0	22.5	23.0	22.0	22.5	22.5
	Site 8	22.0	22.0	22.0	22.0	23.0	23.0	22.5	23.0	22.0	22.5	22.5
	Site 9	22.0	22.0	22.0	22.0	23.0	23.0	22.5	23.0	22.0	22.5	22.5
	Site 10	22.0	22.0	22.0	22.0	23.0	23.0	22.5	23.0	22.0	22.5	22.5
Dissolved Oxygen (mg/L)	Control	6.0	5.5	6.1	6.0	6.2	4.9	4.2	5.3	5.7	5.6	5.3
	Site 1	6.0	5.7	6.0	6.0	6.1	5.0	4.5	5.8	6.4	6.9	6.0
	Site 2	5.7	4.2	5.0	5.1	5.2	4.8	5.2	6.0	6.8	6.9	5.9
	Site 3	5.0	4.8	5.5	5.7	5.9	4.3	4.0	5.5	5.1	5.0	4.7
	Site 4	5.7	5.4	5.6	5.7	6.0	4.7	4.1	5.4	5.6	5.2	5.0
	Site 5	5.8	4.0	4.8	4.9	5.4	4.6	4.3	4.9	5.2	5.0	4.9
	Site 6	5.6	4.1	4.8	4.7	5.0	4.6	4.0	4.8	5.2	5.1	4.8
	Site 7	5.5	5.7	5.3	5.0	5.2	4.8	4.0	4.8	5.2	5.1	4.9
	Site 8	5.6	4.3	4.6	4.7	4.8	4.6	4.1	5.0	5.7	5.5	5.1
	Site 9	5.4	5.3	5.6	5.2	5.0	4.5	4.1	5.1	5.5	5.7	5.3
	Site 10	5.5	5.6	5.9	5.4	5.5	5.0	4.9	6.1	6.4	6.2	5.7
pH	Control	8.0	7.8	7.9	8.0	7.9	7.8	7.3	7.5	7.6	7.8	7.8
	Site 1	8.0	7.7	7.9	8.0	7.9	7.8	7.1	7.6	7.6	7.7	7.8
	Site 2	7.8	7.6	7.7	7.9	8.0	7.7	7.1	7.6	7.6	7.7	7.8
	Site 3	7.7	7.6	7.7	7.9	7.8	7.5	6.6	6.9	7.1	7.4	7.6
	Site 4	7.6	7.6	7.8	7.9	7.9	7.5	6.9	7.1	7.3	7.8	7.8
	Site 5	7.6	7.5	7.6	7.7	7.8	7.3	7.1	7.4	7.6	7.9	7.8
	Site 6	7.6	7.4	7.6	7.7	7.8	7.3	7.2	7.6	7.8	7.7	7.8
	Site 7	7.6	7.4	7.6	7.8	7.8	7.4	7.2	7.6	7.7	7.7	7.8
	Site 8	7.6	7.5	7.5	7.7	7.8	7.4	7.1	7.6	7.7	7.8	7.8
	Site 9	7.6	7.5	7.5	7.6	7.6	7.4	7.1	7.6	7.7	7.8	7.9
	Site 10	7.6	7.5	7.5	7.6	7.7	7.4	7.1	7.6	7.7	7.8	7.8
Initials		MP	JF	MP	MP	MP	MP	JF	MP	MP	MP	MP
Date		9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5

Concentration	Cond. (umhos)		Alkalinity (mg/L)		Hardness (mg/L)		Ammonia (mg/L)		Comments: ① Day 35 ② Day 42
	Initial ①	Final ②	Initial	Final	Initial	Final	Initial	Final	
Control	270	280							
Site 1	265	270							
Site 2	260	270							
Site 3	270	280							
Site 4	265	275							
Site 5	260	275							
Site 6	260	270							
Site 7	260	270							
Site 8	260	280							
Site 9	260	275							
Site 10	265	270							
Initials	MP	MP							
Date	10/8	10/15							

Client/Toxicant: 173
 Job Number: 01-01
 Species: C. tentans

Beginning Date & Time: 9-3-03 1840
 Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Physical / Chemical Parameters

Parameter	Concentration	Day											
		33	34	35	36	37	38	39	40	41	42	43	
TEMP (C)	Control	22.0	24.0	24.0	23.5	23.0	22.0	22.0	22.5	22.5	22.0	22.5	
	Site 1	22.0	24.0	24.0	23.0	23.0	22.0	22.0	22.5	22.5	22.0	22.5	
	Site 2	22.0	24.0	24.0	23.0	23.0	22.0	22.0	22.5	22.5	22.0	22.5	
	Site 3	22.0	24.0	24.0	23.0	23.0	22.0	22.0	22.5	22.5	22.0	22.5	
	Site 4	22.0	24.0	24.0	23.0	23.0	22.0	22.0	22.5	22.5	22.0	22.5	
	Site 5	22.0	24.0	24.0	23.0	23.0	22.0	22.0	22.5	22.5	22.0	22.5	
	Site 6	22.0	24.0	24.0	23.0	23.0	22.0	22.0	22.5	22.5	22.0	22.5	
	Site 7	22.0	24.0	24.0	23.0	23.0	22.0	22.0	22.5	22.5	22.0	22.5	
	Site 8	22.0	24.0	24.0	23.0	23.0	22.0	22.0	22.5	22.5	22.0	22.5	
	Site 9	22.0	24.0	24.0	23.0	23.0	22.0	22.0	22.5	22.5	22.0	22.5	
	Site 10	22.0	24.0	24.0	23.0	23.0	22.0	22.0	22.5	22.5	22.0	22.5	
Dissolved Oxygen (mg/L)	Control	5.9	5.2	5.3	4.4	4.8	6.0	4.6	5.9	5.4	5.8	4.1	
	Site 1	5.7	6.1	6.2	6.6	6.5	6.5	5.2	5.9	5.5	5.9	6.0	
	Site 2	5.7	5.6	5.5	6.3	6.4	6.8	4.5	5.6	5.3	5.7	5.9	
	Site 3	4.7	4.2	4.4	4.0	4.2	5.8	5.1	5.8	4.6	4.8	5.1	
	Site 4	5.3	4.5	4.7	4.8	4.5	6.4	5.0	5.7	5.9	6.1	6.3	
	Site 5	5.6	4.0	4.0	4.4	4.4	5.1	4.0	5.9	5.8	6.0	6.0	
	Site 6	5.8	4.0	4.1	4.3	4.4	5.4	4.6	5.7	5.6	5.8	6.0	
	Site 7	5.8	5.1	5.3	4.8	4.7	5.6	5.1	5.8	5.2	5.4	5.7	
	Site 8	5.4	4.5	4.4	4.5	4.9	6.0	4.5	5.4	5.1	5.4	5.6	
	Site 9	5.5	4.7	4.8	4.9	5.2	5.7	5.4	5.6	5.3	5.4	5.6	
	Site 10	5.7	6.0	6.0	5.7	5.5	6.7	5.6	5.7	5.5	5.6	5.8	
pH	Control	7.8	7.5	7.5	7.4	7.5	7.8	7.6	8.0	7.8	7.8	7.6	
	Site 1	7.8	7.5	7.5	7.4	7.5	7.8	7.6	8.0	7.8	7.7	7.8	
	Site 2	7.7	7.5	7.6	7.4	7.5	7.7	7.6	8.0	7.8	7.7	7.8	
	Site 3	7.6	7.5	7.6	7.4	7.5	7.7	7.6	7.8	7.5	7.4	7.5	
	Site 4	7.7	7.5	7.6	7.4	7.4	7.7	7.6	7.9	7.7	7.6	7.7	
	Site 5	7.7	7.4	7.6	7.5	7.4	7.6	7.5	7.9	7.7	7.7	7.8	
	Site 6	7.7	7.4	7.5	7.5	7.4	7.6	7.5	8.0	7.7	7.7	7.8	
	Site 7	7.8	7.4	7.5	7.5	7.4	7.6	7.5	8.0	7.7	7.8	7.7	
	Site 8	7.8	7.4	7.5	7.5	7.4	7.6	7.5	8.0	7.7	7.8	7.8	
	Site 9	7.8	7.4	7.5	7.5	7.4	7.6	7.5	8.0	7.7	7.8	7.8	
	Site 10	7.8	7.4	7.5	7.6	7.4	7.5	7.4	7.9	7.6	7.7	7.8	
Initials		MP	MP	MP	MP	MP	JP	JP	MP	MP	MP	MP	
Date		10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	

Concentration	Cond. (umhos)		Alkalinity (mg/L)		Hardness (mg/L)		Ammonia (mg/L)	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Control	F275	-						
Site 1	280	270						
Site 2	270	275						
Site 3	285	F280						
Site 4	280	F275						
Site 5	275	F270						
Site 6	275	276						
Site 7	280	275						
Site 8	275	265						
Site 9	280	270						
Site 10	280	270						
Initials	MP							
Date	10/22							

Comments: ① Day 49 unless otherwise marked with F for final conductivity
 ② Day 56

Client/Toxicant: 173
 Job Number: 01-01
 Species: C. tentans

Beginning Date & Time: 9-3-03 1840
 Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Physical / Chemical Parameters

Parameter	Concentration	Day										
		44	45	46	47	48	49	50	51	52	53	54
TEMP (C)	Control	—	—	—	—	—	—	—	—	—	—	—
	Site 1	23.0	22.0	22.0	22.5	24.0	23.0	22.0	22.0	22.0	23.0	23.0
	Site 2	23.0	22.0	22.0	22.5	24.0	23.0	22.0	22.0	22.5	23.0	23.0
	Site 3	23.0	22.0	22.0	22.5	24.0	23.0	22.0	—	—	—	—
	Site 4	23.0	22.0	22.0	22.5	24.0	23.0	22.0	22.0	22.5	23.0	23.0
	Site 5	23.0	22.0	22.0	22.5	24.0	23.0	22.0	—	—	—	—
	Site 6	23.0	22.0	22.0	22.5	24.0	23.0	22.0	22.0	22.5	23.0	23.0
	Site 7	23.0	22.0	22.0	22.5	23.5	23.0	22.0	22.0	22.5	23.0	23.0
	Site 8	23.0	22.0	22.0	22.5	23.5	23.0	22.0	22.0	22.5	23.0	23.0
	Site 9	23.0	22.0	22.0	22.5	23.5	23.0	22.0	22.0	22.0	23.0	23.0
	Site 10	23.0	22.0	22.0	22.5	23.5	23.0	22.0	22.0	22.0	23.0	23.0
Dissolved Oxygen (mg/L)	Control	—	—	—	—	—	—	—	—	—	—	—
	Site 1	5.3	5.1	6.0	5.7	5.3	5.5	6.0	6.1	6.0	6.2	6.4
	Site 2	5.5	5.2	5.9	6.1	5.3	5.4	6.0	6.1	6.3	6.0	6.1
	Site 3	4.2	4.2	4.8	5.1	4.7	5.0	6.1	—	—	—	—
	Site 4	5.4	5.0	5.6	5.9	5.1	5.0	5.8	5.7	5.9	6.0	6.2
	Site 5	5.2	4.3	4.4	4.9	4.2	5.1	5.6	—	—	—	—
	Site 6	5.2	4.3	4.9	5.2	3.5	4.3	5.0	5.2	5.0	6.0	6.1
	Site 7	5.1	4.5	5.6	5.9	4.6	4.8	5.2	5.6	5.3	5.6	6.0
	Site 8	5.0	4.1	4.6	5.2	4.8	5.2	5.9	6.1	5.8	5.7	6.1
	Site 9	4.9	4.0	5.0	5.5	4.1	4.4	5.3	5.8	5.6	5.0	5.8
	Site 10	5.0	5.0	5.9	6.0	5.1	5.3	5.8	6.2	5.9	5.0	5.8
pH	Control	—	—	—	—	—	—	—	—	—	—	—
	Site 1	7.6	7.7	7.7	7.8	8.0	7.9	7.8	7.8	7.7	7.8	7.8
	Site 2	7.6	7.7	7.7	7.8	8.0	7.9	7.8	7.8	7.7	7.8	7.8
	Site 3	7.4	7.5	7.7	7.7	7.9	7.9	7.8	—	—	—	—
	Site 4	7.5	7.5	7.7	7.8	7.8	7.9	7.8	7.7	7.6	7.7	7.8
	Site 5	7.6	7.5	7.7	7.8	7.8	7.8	7.8	—	—	—	—
	Site 6	7.6	7.5	7.7	7.8	7.8	7.8	7.7	7.7	7.7	7.7	7.8
	Site 7	7.6	7.5	7.6	7.8	7.8	7.8	7.7	7.7	7.6	7.7	7.8
	Site 8	7.6	7.5	7.6	7.8	7.8	7.7	7.7	7.7	7.6	7.7	7.8
	Site 9	7.6	7.4	7.6	7.7	7.7	7.7	7.7	7.7	7.6	7.7	7.8
	Site 10	7.5	7.4	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.8
Initials		TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP	TAP
Date		10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27

Concentration	Cond. (umhos)		Alkalinity (mg/L)		Hardness (mg/L)		Ammonia (mg/L)	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Control	—	—	—	—	—	—	—	—
Site 1	F270	—	—	—	—	—	—	—
Site 2	—	F295	—	—	—	—	—	—
Site 3	—	—	—	—	—	—	—	—
Site 4	—	—	—	—	—	—	—	—
Site 5	—	—	—	—	—	—	—	—
Site 6	280	F285	—	—	—	—	—	—
Site 7	270	F280	—	—	—	—	—	—
Site 8	F275	—	—	—	—	—	—	—
Site 9	270	F285	—	—	—	—	—	—
Site 10	F280	—	—	—	—	—	—	—
Initials	TAP	TAP	—	—	—	—	—	—
Date	Various	11/7	—	—	—	—	—	—

Comments: ① Day 63 unless
 otherwise marked with
 a F for Final Conductivity
 ② Day 265

Client/Toxicant: 173
 Job Number: 01-01
 Species: C. tentans

Beginning Date & Time: 9-3-03 1840
 Ending Date & Time: 11-07-03 1200

Freshwater Sediment Test
 American Aquatic Testing, Inc.,
 Physical / Chemical Parameters

Parameter	Concentration	Day											
		55	56	57	58	59	60	61	62	63	64	65	
TEMP (C)	Control	-	-	-	-	-	-	-	-	-	-	-	
	Site 1	23.0	23.0	22.0	22.0	23.5	-	-	-	-	-	-	
	Site 2	23.0	23.0	22.0	22.0	23.5	22.5	23.0	22.0	22.5	-	-	
	Site 3	-	-	-	-	-	-	-	-	-	-	-	
	Site 4	-	-	-	-	-	-	-	-	-	-	-	
	Site 5	-	-	-	-	-	-	-	-	-	-	-	
	Site 6	23.0	23.0	22.0	22.0	23.5	22.5	23.0	22.0	22.5	22.5	23.0	
	Site 7	23.0	23.0	22.0	22.0	23.5	22.5	23.0	22.0	22.5	22.5	23.0	
	Site 8	23.0	23.0	22.0	22.0	23.5	22.5	23.0	-	-	-	-	
	Site 9	23.0	23.0	22.0	22.0	23.5	22.5	23.0	22.5	22.5	22.5	23.0	
	Site 10	23.0	23.0	22.0	-	-	-	-	-	-	-	-	
Dissolved Oxygen (mg/L)	Control	-	-	-	-	-	-	-	-	-	-	-	
	Site 1	6.3	6.5	6.9	6.4	6.3	-	-	-	-	-	-	
	Site 2	6.1	6.2	6.9	6.8	6.5	7.6	6.8	7.3	7.1	-	-	
	Site 3	-	-	-	-	-	-	-	-	-	-	-	
	Site 4	-	-	-	-	-	-	-	-	-	-	-	
	Site 5	-	-	-	-	-	-	-	-	-	-	-	
	Site 6	6.1	6.3	6.9	6.6	6.6	7.5	6.9	6.9	7.0	6.9	6.4	
	Site 7	5.9	6.1	6.5	6.5	6.5	6.8	6.7	6.6	6.6	6.5	6.2	
	Site 8	5.9	6.0	6.7	6.2	6.4	6.9	6.5	-	-	-	-	
	Site 9	5.8	6.0	6.8	6.6	6.5	7.0	6.7	7.0	6.9	7.0	6.3	
	Site 10	5.8	5.9	6.8	-	-	-	-	-	-	-	-	
pH	Control	-	-	-	-	-	-	-	-	-	-	-	
	Site 1	7.8	7.8	8.1	7.3	7.6	-	-	-	-	-	-	
	Site 2	7.8	7.8	8.0	7.3	7.6	7.6	7.7	7.8	7.9	-	-	
	Site 3	-	-	-	-	-	-	-	-	-	-	-	
	Site 4	-	-	-	-	-	-	-	-	-	-	-	
	Site 5	-	-	-	-	-	-	-	-	-	-	-	
	Site 6	7.8	7.8	8.0	7.3	7.7	7.6	7.7	7.8	7.8	7.8	7.7	
	Site 7	7.8	7.8	8.0	7.4	7.7	7.6	7.7	7.8	7.8	7.8	7.7	
	Site 8	7.8	7.8	8.0	7.4	7.8	7.6	7.8	-	-	-	-	
	Site 9	7.7	7.8	8.0	7.4	7.7	7.7	7.8	7.8	7.8	7.8	7.8	
	Site 10	7.7	7.8	8.0	-	-	-	-	-	-	-	-	
Initials		WJ	WJ	WJ	JH	WJ	JF	WJ	WJ	JF	WJ	WJ	
Date		10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	

Concentration	Cond. (umhos)		Alkalinity (mg/L)		Hardness (mg/L)		Ammonia (mg/L)		Comments:
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
Control	-	-	-	-	-	-	-	-	
Site 1	-	-	-	-	-	-	-	-	
Site 2	-	-	-	-	-	-	-	-	
Site 3	-	-	-	-	-	-	-	-	
Site 4	-	-	-	-	-	-	-	-	
Site 5	-	-	-	-	-	-	-	-	
Site 6	-	-	-	-	-	-	-	-	
Site 7	-	-	-	-	-	-	-	-	
Site 8	-	-	-	-	-	-	-	-	
Site 9	-	-	-	-	-	-	-	-	
Site 10	-	-	-	-	-	-	-	-	
Initials									
Date									

Freshwater Acute Test

American Aquatic Testing, Inc.

Job #: SRT #16

Start Date & Time: 9-3-03 1610

Species: C. tentans

End Date & Time: 9-5-03 1710

Dilution Water: EPA Mod. Hard

Test Type: 48 hr. SNR

Concentration	Rep.	Live Count			Temperature (C)		
		0 hr.	24 hr.	48 hr.	0 hr.	24 hr.	48 hr.
CONTROL	A	12	12	12	23.0	22.5	22.5
	B	12	12	12	23.0	22.5	22.5
625 ppm	A	12	12	12	23.0	22.5	22.5
	B	12	12	11	23.0	22.5	22.5
1250 ppm	A	12	12	12	23.0	22.5	22.5
	B	12	12	12	23.0	22.5	22.5
2500 ppm	A	12	12	5 ⁸	23.0	22.5	22.5
	B	12	12	6 ⁶	23.0	22.5	22.5
5000 ppm	A	12	9 ²	0 ⁹	23.0	22.5	22.5
	B	12	10 ²	0 ¹⁰	23.0	22.5	22.5
10000 ppm	A	12	0 ¹²	-	23.0	22.5	-
	B	12	0 ¹²	-	23.0	22.5	-
Initials		TDP	TDP	TDP	TDP	TDP	MP
Date		9/3	9/4	9/5	9/3	9/4	9/5

Concentration	Alkalinity (mg/L)	Hardness (mg/L)
Control	40	80
10000 ppm	80	100
Initials	TDP	TDP
Date	9/3	9/3

Concentration	pH (std units)		Dissolved Oxygen (mg/L)		Conductivity (umhos)	
	0 hr.	48 hr.	0 hr.	48 hr.	0 hr.	48 hr.
Control	7.5	7.5	7.7	8.1	280	300
625 ppm	7.5	7.5	7.7	8.1	1500	1500
1250 ppm	7.6	7.6	7.7	8.1	2450	2500
2500 ppm	7.6	7.7	7.7	8.1	4500	4500
5000 ppm	7.7	7.8	7.7	8.1	9000	9000
10000 ppm	7.8	7.7 ^①	7.7	7.7 ^①	17000	18000 ^①
Initials	TDP	MP	TDP	MP	TDP	TDP
Date	9/3	9/5	9/3	9/4	9/3	9/5

Observations: ① Readings done at 24hrs. due to total mortality

Acute Fish Test-48 Hr Survival

Start Date: 9/3/2003 Test ID: kcctsu16 Sample ID: SRT #16 KCI
 End Date: 9/5/2003 Lab ID: AAT Inc Sample Type: Prepared
 Sample Date: Protocol: EPAA 91-EPA Acute Test Species: DM-Daphnia magna
 Comments: CT.Chironomus tentans

Conc-ppm	1	2
Control	1.0000	1.0000
625	1.0000	0.9167
1250	1.0000	1.0000
2500	0.4167	0.5000
5000	0.0000	0.0000
10000	0.0000	0.0000

Transform: Arcsin Square Root								Number	Total
Conc-ppm	Mean	N-Mean	Mean	Min	Max	CV%	N	Resp	Number
Control	1.0000	1.0000	1.4260	1.4260	1.4260	0.000	2	0	24
625	0.9583	0.9583	1.3520	1.2780	1.4260	7.741	2	1	24
1250	1.0000	1.0000	1.4260	1.4260	1.4260	0.000	2	0	24
2500	0.4583	0.4583	0.7435	0.7017	0.7854	7.962	2	13	24
5000	0.0000	0.0000	0.1448	0.1448	0.1448	0.000	2	24	24
10000	0.0000	0.0000	0.1448	0.1448	0.1448	0.000	2	24	24

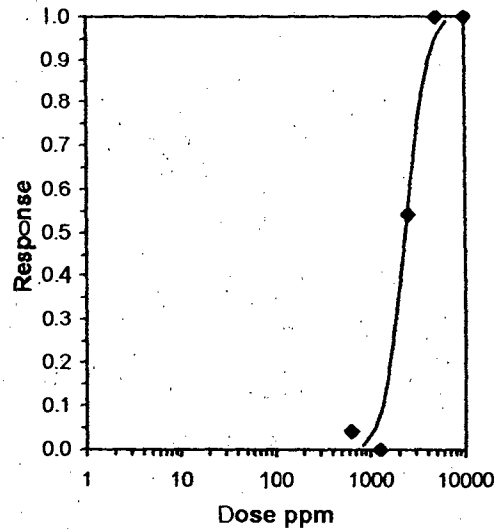
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Normality of the data set cannot be confirmed				
Equality of variance cannot be confirmed				

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits	Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	5.21089	2.71215	-3.4204 13.8422	0	27.5229	7.81472	4.6E-06	3.36193	0.19191	5
Intercept	-12.519	9.13578	-41.593 16.5555							
TSCR										

Point	Probits	ppm	95% Fiducial Limits
EC01	2.674	823.171	
EC05	3.355	1112.43	
EC10	3.718	1306.15	
EC15	3.964	1455.57	
EC20	4.158	1586.42	
EC25	4.326	1708.01	
EC40	4.747	2057.36	
EC50	5.000	2301.07	
EC60	5.253	2573.64	
EC75	5.674	3100.04	
EC80	5.842	3337.65	
EC85	6.036	3637.7	
EC90	6.282	4053.84	
EC95	6.645	4759.77	
EC99	7.326	6432.33	

Significant heterogeneity detected (p = 4.57E-06)



SEVERN
TRENT

STL

STL Edison
777 New Durham Road
Edison, NJ 08817

Tel: 732 549 3900 Fax: 732 549 3679
www.stl-inc.com

11/11/2003

American Aquatic Testing, Inc.
1105 Union Blvd.
Allentown, PA 10103

Attention: Mr. Chris Nally

Laboratory Results
Job No. P756 - Solids Testing

Dear Mr. Nally:

Enclosed are the results you requested for the following sample(s) received at our laboratory on September 25, 2003.

<u>Lab No.</u>	<u>Client ID</u>	<u>Analysis Required</u>
464604	01	TOC Grain Size

An invoice for our services is also enclosed. If you have any questions please contact your Project Manager, Heather Menzel, at (732) 549-3900.

Very Truly Yours,

Michael J. Urban

Michael J. Urban
Laboratory Manager

Mr. Chris Nally
American Aquatic Testing, Inc.
1105 Union Blvd.
Allentown, PA 10103

Report Date: 11/10/2003
Lab Job Number: P756
Lab Sample ID: 464604
Date Sampled: 08/26/2003
Date Received: 09/25/2003

Sample Description: Solids Testing - 01

	Results	Unit	Det. Limit	Procedure	Lower Limit	Upper Limit	Analysis Date	Dilution
WET CHEM								
Total Organic Carbon	30300	mg/kg	100	LLOYD KAHN	--	--	09/29/2003	5.0

Particle Size of Soils by ASTM D422

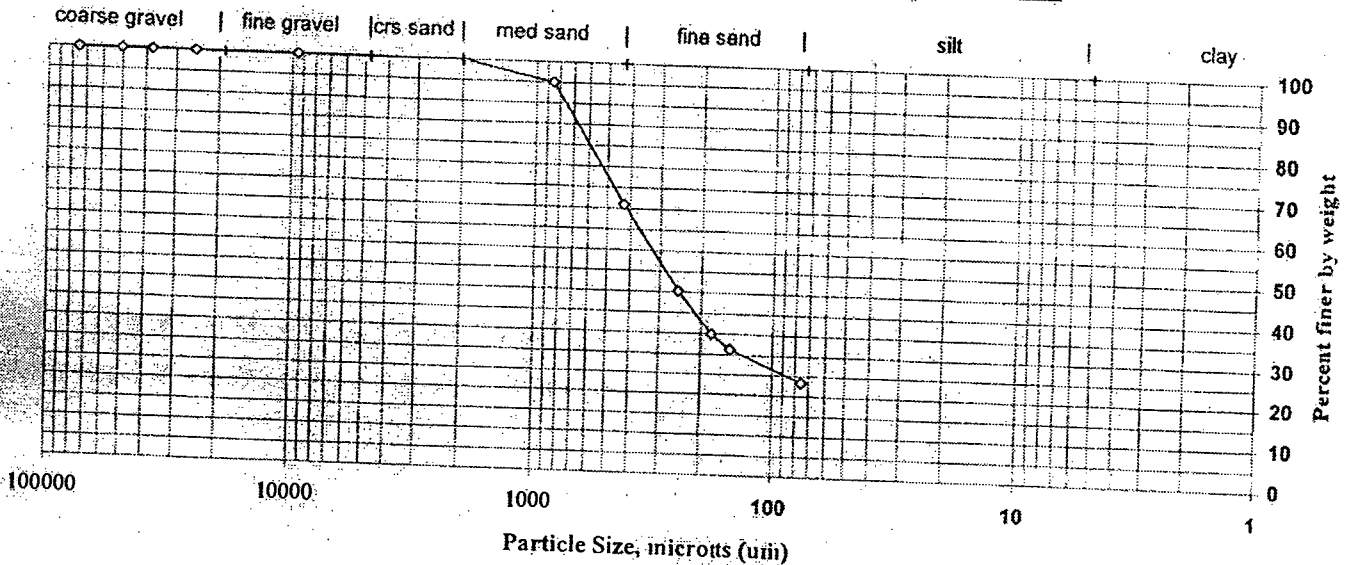
Sample preparation method: D2217
 Client: STLNJE Project No.: 23011 ETR(s) #: 96179
 Client Code: STLNJE Job No.: N/A SDG(s): P756
 Date Received: 29-Sep-03 Start Date: 29-Sep-03 End Date: 1-Oct-03

Lab ID: 543445

Sample ID: 464604

Percent Solids: 70.6%
 Specific Gravity: 2.65 (assumed)
 Non-soil mass: NA

Maximum Particle Size: Med sand
 Shape (> #10): N/A
 Hardness (> #10): N/A



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	95.0	5.0
#40	425	66.0	29.1
#60	250	45.2	20.7
#80	180	34.9	10.3
#100	150	31.4	3.6
#200	75	23.3	8.0
Hydrometer	0.0	0.0	23.3
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
	0.0	0.0	0.0
V	0.0	0.0	0.0

Soil Classification	Percent or Total Sample
Gravel	0.0
Sand	76.7
Coarse Sand	0.0
Medium Sand	34.0
Fine Sand	42.7
Fines	23.3

Particle Size Analysis
Hydrometer Data

Set Number
P756

Client: STLNJE
Client Code: STLNJE
Date Received: 29-Sep-03

Project No.: 23011
Job No.: N/A
Start Date: 29-Sep-03

ETR(s) #: 96179
SDG(s): P756
End Date: 1-Oct-03

Date and Analyst

Percent Solids	Weighed/Mixed	Hydrometer	Large sieves	Non-soil	Small Sieve
<u>CJC 9/30/03</u>	<u>CJC 9/30/03</u>	(Sieve Only)	<u>CJC 9/30/03</u>	<u>CJC 9/30/03</u>	<u>CJC 9/30/03</u>
<u>CJC 10/1/03</u>	<u>CJC 9/30/03</u>		<u>CJC 10/1/03</u>	<u>CJC 10/1/03</u>	<u>CJC 10/1/03</u>

Test number
Lab number

1	2	3	4	5	6	7	8	9	10	11	12
S43445											

Time, min. (2)
Reading
Temperature, C

Time, min. (5)
Reading
Temperature, C

Time, min. (15)
Reading
Temperature, C

Time, min. (30)
Reading
Temperature, C

Time, min. (60)
Reading
Temperature, C

Time, min. (250)
Reading
Temperature, C

Time, min. (1440)
Reading
Temperature, C

Hydrometer used:	<u>N/A</u>	Model #:	<u>N/A</u>
Calibrations:	L temp, C	L read	H Temp, C
	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>

Manufacturer: N/A
Gal. Date: N/A

Hydrometer start time: N/A
Hydrometer data entered: N/A

"Sieve Only" Analysis Requested. Hydrometer test not performed

10/2/2003

STL Burlington

P756SO::Hydrometer

STL Edison

P756

Particle Size Analysis
Hydrometer Data

Set Number
P756

Cliat: STLNJE
Client Code: STLNJE
Date Received: 29-Sep-03

Project No.: 23011
Job No.: N/A
Start Date: 29-Sep-03

ETR(s) #: 96179
SDG(s): P756
End Date: 10-1-03

Date and Analyst					
Percent Solids	Weighed/Mixed	Hydrometer	Large sieves	Non-soil	Small Sieves
CSC 9130103	CSC 9130103	(Sieve Only)	CSC 9130103	CSC 9130103	CSC 9130103
CSC 1011103	CSC 9130103		CSC 1011103	CSC 1011103	CSC 1011103

Test number
Lab number
Time, min. (2)
Reading
Temperature, C
Time, min. (5)
Reading
Temperature, C
Time, min. (15)
Reading
Temperature, C
Time, min. (30)
Reading
Temperature, C
Time, min. (60)
Reading
Temperature, C
Time, min. (250)
Reading
Temperature, C
Time, min. (1440)
Reading
Temperature, C

1	2	3	4	5	6	7	8	9	10	11	12
543445											
"Sieve Only" Analysis Requested. Hydrometer test not performed.											

Hydrometer used: N/A Model #: N/A
Calibrations: L temp, C L read H Temp, C H read
N/A N/A N/A N/A

Manufacturer: N/A Hydrometer start time: N/A
Cal. Date: N/A Hydrometer data entered: N/A

SEVERN
TRENT

STL

Sample Preparation
And
Equipment Calibration
Information

0007

Particle Size Analysis
Sieve Data

Client: **STL**
Client Code: **STL**
SET: **P756**

ETR(s): **96179**
SDG(s): **P756**

Project: **23011**
Case: **23011**

Date Rec: **29-Sep-03**

Start Date: **29-Sep-03**
End Date: **1-Oct-03**

6

Dry prep = D42i
Wet prep = D2217

Tcsr
Laboratory No
Sample ID

Sample Prep Method D2217

Pan, g

Pan/sample, g

Pan/dry sampl, g

Non-soil material

Description

Pan, g

Pan/dry sampl, g

Non-sol, g

Hydroscopic Moisture correction factor (HMCF) for dry prep / Percent Solids for dry and wet prep

Pan, g

Pan/sample, g

Pan/dry sampl, g

HMCF

Sample % Solids 70.6%

Sample used, g 85.06

Standard
Values

Sieve	Opening, um
3 inch	75000
2 inch	50000
1.5 inch	37500
1 inch	25000
3/4 inch	19000
3/8 inch	9500
#4	4750
#10	2000
#20	850
#40	425
#60	250
#80	180
#100	150
#200	75

Sieve (tares)

Size	Mass, g
3 inch	
2 inch	
1.5 inch	
1 inch	
3/4 inch	
3/8 inch	
#4	
#10	37.34
#20	385.42
#40	345.68
#60	326.70
#80	313.05
#100	304.42
#200	326.93

Sieve + Sample Weights

Size	Mass, g	Mass, g	Mass, g	Mass, g	Mass, g	Mass, g	Mass, g	Mass, g	Mass, g	Mass, g	Mass, g	Mass, g	Mass, g
3 inch													
2 inch													
1.5 inch													
1 inch													
3/4 inch													
3/8 inch													
#4													
#10	0.00												
#20	385.64												
#40	371.41												
#60	343.33												
#80	321.83												
#100	322.50												
#200	333.83												

Maximum Particle size

Med sand

Description of >#10 particles

Shape

Hardness

Sample Mass Parameters

Pan/sample, g

Mass retained, g

Sample mass, g

120.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
85.06													

10/2/2003

STL Edison

P756

STL Edison

P756

Balance Calibration Log

Type:	Mettler PB3002-S
Serial #:	1120173088
Asset #:	n/a
Location:	Soils Lab
Calibrate to:	2000g

Date	Time	Calibration Weight	Initials	Date	Time	Calibration Weight	Initials
01-Sep-03	07:00	2000.00	DJP	17-Sep-03	07:51	2000.00	DJP
02-Sep-03	06:50	2000.00	MW	18-Sep-03	07:30	2000.00	CSC
03-Sep-03	08:00	2000.00	DJP	19-Sep-03	06:30	2000.00	CSC
04-Sep-03	06:15	2000.00	CSC	20-Sep-03			
05-Sep-03	06:00	2000.00	DMA	21-Sep-03			
				22-Sep-03	07:00	2000.00	CSC
				23-Sep-03	07:15	2000.00	MW
08-Sep-03	06:50	2000.00	MW	24-Sep-03	07:20	2000.00	CSC
09-Sep-03	06:15	2000.00	MW	25-Sep-03	07:20	2000.00	CSC
10-Sep-03	06:25	2000.00	MW	26-Sep-03	07:20	2000.00	CSC
11-Sep-03	06:35	2000.00	CSC	27-Sep-03			
12-Sep-03	06:30	2000.00	MW	28-Sep-03			
				29-Sep-03	08:30	2000.00	CSC
				30-Sep-03	08:00	2000.00	CSC
15-Sep-03	06:15	2000.00	MW	01-Oct-03			
16-Sep-03	10:20	2000.00	DJP				

Oven #1 Quality Control Log

Type:	Baxter/Scientific Products (H6620-13A)
Serial #:	1090-0313
Asset #:	N/A
Location:	Soils Lab
Calibration Range:	110°C ±5

Date	Temperature	Oven Setting	Initials
01-Sep-03	115°	5.6	DTX
02-Sep-03	110°	5.4	CSC
03-Sep-03	110°	5.5	DTX
04-Sep-03	110°	5.5	CSC
05-Sep-03	105°	6.0	DMA
06-Sep-03	110°	5.5	DTX
07-Sep-03	110°	5.5	DTX
08-Sep-03	115°	5.6	MRO
09-Sep-03	110°	5.5	MRO
10-Sep-03	115°	5.8	MRO
11-Sep-03	112°	5.8	CSC
12-Sep-03	108°	5.8	MRO
13-Sep-03	110°	5.5	MRO
14-Sep-03	110°	5.5	MRO
15-Sep-03	110°	6.0	MRO
16-Sep-03	115°	5.8	DTX

Date	Temperature	Oven Setting	Initials
17-Sep-03	105°	5.8	CSC
18-Sep-03	114°	5.6	CSC
19-Sep-03	108°	5.0	CSC
20-Sep-03	108°	5.0	CSC
21-Sep-03	105°	5.0	CSC
22-Sep-03	105°	5.0	CSC
23-Sep-03	105°	5.0	CSC
24-Sep-03	114°	5.0	CSC
25-Sep-03	105°	5.0	CSC
26-Sep-03	108°	5.0	CSC
27-Sep-03	108°	5.0	CSC
28-Sep-03	110°	5.0	CSC
29-Sep-03	110°	5.0	CSC
30-Sep-03	110°	5.0	CSC
01-Oct-03			

Oven #2 Quality Control Log

Type:	Baxter/Scientific Products (H6620-13A)
Serial #:	0292-0485
Asset #:	3333
Location:	Soils Lab
Calibration Range:	110°C ±5

Date	Temperature	Oven Setting	Initials
01-Sep-03	113°	6.0	DTP
02-Sep-03	109°	6.0	CSC
03-Sep-03	110°	6.0	DTP
04-Sep-03	110°	6.0	CSC
05-Sep-03	115°	6.0	DMA
06-Sep-03	108°	6.0	DTP
07-Sep-03	108°	6.0	CSC
08-Sep-03	110°	6.0	MRO
09-Sep-03	112°	6.0	MRO
10-Sep-03	112°	6.0	MRO
11-Sep-03	112°	6.0	CSC
12-Sep-03	108°	6.0	MRO
13-Sep-03			
14-Sep-03			
15-Sep-03	108°	6.0	MRO
16-Sep-03	115°	6.0	DTP

Date	Temperature	Oven Setting	Initials
17-Sep-03	115°	6.0	CSC
18-Sep-03	111°	6.0	CSC
19-Sep-03	108°	6.0	CSC
20-Sep-03			
21-Sep-03			
22-Sep-03	109°	6.0	CSC
23-Sep-03	108°	6.0	MRO
24-Sep-03	108°	6.0	CSC
25-Sep-03	105°	6.0	CSC
26-Sep-03	110°	6.0	CSC
27-Sep-03			
28-Sep-03			
29-Sep-03	115°	6.0	CSC
30-Sep-03	112°	6.0	CSC
01-Oct-03			

Balance Calibration Log

Type:	Mettler PB3002-S
Serial #:	1120173088
Asset #:	n/a
Location:	Soils Lab
Calibrate to:	2000g

Date	Time	Calibration Weight	Initials	Date	Time	Calibration Weight	Initials
01-Oct-03	08:00	2000.00	DTJ	17-Oct-03			
02-Oct-03	06:30	2000.00	CTC	18-Oct-03			
03-Oct-03				19-Oct-03			
04-Oct-03				20-Oct-03			
05-Oct-03				21-Oct-03			
06-Oct-03				22-Oct-03			
07-Oct-03				23-Oct-03			
08-Oct-03				24-Oct-03			
09-Oct-03				25-Oct-03			
10-Oct-03				26-Oct-03			
11-Oct-03				27-Oct-03			
12-Oct-03				28-Oct-03			
13-Oct-03				29-Oct-03			
14-Oct-03				30-Oct-03			
15-Oct-03				31-Oct-03			
16-Oct-03							

Balance Calibration Log

Type:	Mettler Toledo PB3002
Serial #:	1116283195
Asset #:	N/A
Location:	Soils Lab
Calibrate to:	2000g

Date	Time	Calibration Weight	Initials	Date	Time	Calibration Weight	Initials
01-Oct-03	08:01	2000.00	DJ	17-Oct-03			
02-Oct-03	06:30	2000.00	CSC	18-Oct-03			
03-Oct-03				19-Oct-03			
04-Oct-03				20-Oct-03			
05-Oct-03				21-Oct-03			
06-Oct-03				22-Oct-03			
07-Oct-03				23-Oct-03			
08-Oct-03				24-Oct-03			
09-Oct-03				25-Oct-03			
10-Oct-03				26-Oct-03			
11-Oct-03				27-Oct-03			
12-Oct-03				28-Oct-03			
13-Oct-03				29-Oct-03			
14-Oct-03				30-Oct-03			
15-Oct-03				31-Oct-03			
16-Oct-03							

Oven #1 Quality Control Log

Type:	Baxter/Scientific Products (H6620-13A)
Serial #:	1090-0313
Asset #:	N/A
Location:	Soils Lab
Calibration Range:	110°C ±5

Date	Temperature	Oven Setting	Initials
01-Oct-03	115°	5.1	DJP
02-Oct-03	110°	5.1	CSC
03-Oct-03			
04-Oct-03			
05-Oct-03			
06-Oct-03			
07-Oct-03			
08-Oct-03			
09-Oct-03			
10-Oct-03			
11-Oct-03			
12-Oct-03			
13-Oct-03			
14-Oct-03			
15-Oct-03			
16-Oct-03			

Date	Temperature	Oven Setting	Initials
17-Oct-03			
18-Oct-03			
19-Oct-03			
20-Oct-03			
21-Oct-03			
22-Oct-03			
23-Oct-03			
24-Oct-03			
25-Oct-03			
26-Oct-03			
27-Oct-03			
28-Oct-03			
29-Oct-03			
30-Oct-03			
31-Oct-03			

Oven #2 Quality Control Log

Type:	Baxter/Scientific Products (H6620-13A)
Serial #:	0292-0485
Asset #:	3333
Location:	Soils Lab
Calibration Range:	110°C ±5

Date	Temperature	Oven Setting	Initials
01-Oct-03	114°	5.9	DJP
02-Oct-03	110°	5.9	CSL
03-Oct-03			
04-Oct-03			
05-Oct-03			
06-Oct-03			
07-Oct-03			
08-Oct-03			
09-Oct-03			
10-Oct-03			
11-Oct-03			
12-Oct-03			
13-Oct-03			
14-Oct-03			
15-Oct-03			
16-Oct-03			

Date	Temperature	Oven Setting	Initials
17-Oct-03			
18-Oct-03			
19-Oct-03			
20-Oct-03			
21-Oct-03			
22-Oct-03			
23-Oct-03			
24-Oct-03			
25-Oct-03			
26-Oct-03			
27-Oct-03			
28-Oct-03			
29-Oct-03			
30-Oct-03			
31-Oct-03			

Sodium Hexametaphosphate

Quality Control Log

[illegible]

Note: * No expiration date noted on container. Date is one year from opening.

SEVERN
TRENT

STL

SAMPLE HANDLING

ORIGIN ID: LDJA (732) 549-3900
STL EDISON
SEVERN TRENT LABS INC.
777 NEW DURHAM RD
EDISON, NJ 08817

SHIP DATE: 26SEP03
SYSTEM #0608503 / CAFE2165
ACTUAL WGT: 4 LBS. MAN-WGT
ACCOUNT #: 237255912

FedEx

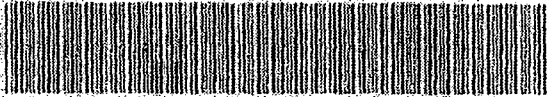


FedEx Revenue Barcode

TO:

SAMPLE RECEIVING (S02) 655-1203
STL BURLINGTON
200 SOUTH PARK DRIVE
SUITE 1
COLCHESTER, VT 05446

REP:



Delivery Address Barcode (FedEx-EDR)

PRIORITY OVERNIGHT

TRK#

4783 2077 5966 FORM 0201

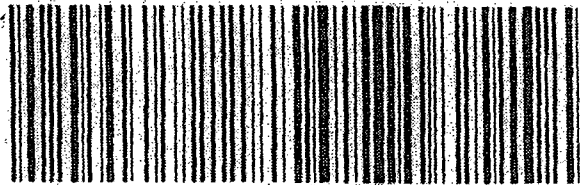
MON
Deliver by
29SEP03
AA

BTV

05446

-VT-US

KF BTVA



PRV # 154254354 RT 0203

Jennifer Gray
929.03
1000

0019

STL Edison

SEVERN TRENT LABORATORIES LOG-IN SHEET - Form DC-1

Lab Name: STL Burlington

Page 1 of 1

Received By (Print or Type Name): Jennifer L. Guy

Log-in Date: 09/29/03

Received By (Signature): 

Case Number: 23011

Sample Delivery Group No.: P756

ETR Number: 96179

CORRESPONDING

REMARKS:

1. Custody Seal Absent*
2. Custody Seal Nos: NA
3. Chain-of-Custody Records Present
4. Sample Information Sheets Absent*
5. Airbill Present As Sticker
6. Airbill Number(s): 478320775966
7. Sample Tags Absent*
8. Tag Nos. Listed on COC N/A
9. Sample Condition: Intact
10. VOA Vial Bubbles N/A
11. Does info on the custody records, sample info sheets, sample tags and labels agree? Yes
12. Date Received at Lab: 09/29/03
13. Time Received at Lab: 1000
14. Cooler Temperature(s): 17 C

SAMPLE TRANSFER:

Fraction(s): ALL

Area Number: Level 4 Storage

Transferred By: JLG

Transferred On: 09/29/03

CLIENT
SAMPLE #SAMPLE
TAG #ASSIGNED
LAB #REMARKS: CONDITION
OF SAMPLE SHIPMENT
ETC.

464604

NA

543445

JLG 10.10.03

STL Burlington
COCLER RECEIPT CHECKLIST

Date Received: 09.29.03

Sample Custodian: JLG

Time Received: 10⁰⁰

ETR/SDG: 91479/P756

RADIATION SCREEN: <0.05 MR/HR
If yes, stop work and alert the Supervisor and the PM.

YES

NO

CUSTODY SEALS PRESENT:

YES

NO

If yes, were the custody seals signed?

YES

NO

If yes, are custody seal numbers present?

YES

NO

List custody seal numbers: _____

TEMPERATURE CHECK: 17 (°C)

Acceptance Criteria (0-6°C) except air samples, which should be shipped at ambient temperature and/or biota/tissue samples, which may be frozen on receipt. The thermal preservation of samples that are hand delivered immediately following collection is considered acceptable if there is evidence that the chilling process has begun.

Thermal Preservation Type:

ICE

ICE PACK

NONE

CONDITION OF SAMPLE CONTAINERS:

INTACT

BROKEN

If broken, list the client ID for each broken container:

Were any samples received with a short hold time* remaining?
* <7 Days

WET CHEMISTRY

YES

NO

METALS

YES

NO

ORGANIC EXTRACTABLES

YES

NO

VOLATILE (received unpreserved)

YES

NO

If yes, expedite sample log in procedure and alert the appropriate Department Manager.

0021

DATA REPORTING QUALIFIERS

- < - The compound was not detected at the indicated concentration.
- > - The compound exceeded the indicated concentration.
- ** - Not included in initial calibration.
- E - Estimated concentration for non target compound.
- _ - Tentatively Identified Compounds (TIC).

MICROBIOLOGY DATA REPORTING QUALIFIERS

Present - Presence of bacterial genus.

Absent - Absence of bacterial genus.



STL

Nonconformance Summary

STL Edison Job Number: P756

Client: American Aquatic Testing, Inc.

Date: 11/10/2003

Sample Receipt:

Sample delivery conforms with requirements.

Wet Chemistry \ Microbiology:

All data conforms with method requirements.

Sub Work:

See STL Burlington case narrative

I certify that the test results contained in this data package meet all requirements of NELAC both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this package has been authorized by the Laboratory Manager or his designee, as verified by the following signature.

Sharon Ercoliani for

Michael J. Urban
Laboratory Manager

STATISTICAL DATA FOR *Chironomus tentans*

FIRST EMERGENCE

WITH CONTROL & REFERENCE SEDIMENTS

Table 1: Average Time to First Emergence; Matteo Metals Start Date 09/03/03
Comparison to Reference Sites 8 and 9 Included

Site ID	Ave. # days to 1st Emergence	% of 65 day Exposure	Significant VS. Site 8?	Significant VS. Site 9?
Control	29.2	44.9	N/A ¹	N/A ¹
3	51.2	78.8	YES ²	YES ²
4	41.6	64.0	No	No
5	40.8	62.8	No	No
6	36.6	56.3	No	No
7	33.6	51.7	No	No
8	31.4	48.3	-	N/A ¹
9	30.8	47.4	N/A ¹	-
10	31.2	51.1	No	No

1 - Control sample not included in Site analysis

2- Site 3 significant delay to 1st emergence vs Reference sites 8 and 9

Matteo Metals 1st Emergence start date 09/03/03

File: d:\toxstat\1730101e.me8

Transform: 1/(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Ref. Site 8	5	1.403	1.523	1.441
2	Site 3	5	1.000	1.523	1.185
3	site 4	5	1.000	1.403	1.280
4	Site 5	5	1.000	1.403	1.295
5	Site 6	5	1.229	1.426	1.340
6	Site 7	5	1.291	1.471	1.396
7	Site 10	5	1.363	1.497	1.402

Matteo Metals 1st Emergence start date 09/03/03

File: d:\toxstat\1730101e.me8

Transform: 1/(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Ref. Site 8	0.002	0.047	0.021	3.28
2	Site 3	0.066	0.257	0.115	21.70
3	site 4	0.027	0.163	0.073	12.73
4	Site 5	0.028	0.167	0.075	12.87
5	Site 6	0.008	0.089	0.040	6.68
6	Site 7	0.006	0.079	0.035	5.68
7	Site 10	0.003	0.056	0.025	3.98

1ST EMERGENCE USING SITE 8 AS REFERENCE

Matteo Metals 1st Emergence start date 09/03/03

File: d:\toxstat\1730101e.me8 Transform: 1/(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.561

W = 0.957

Critical W (P = 0.05) (n = 35) = 0.934

Critical W (P = 0.01) (n = 35) = 0.910

Data PASS normality test at P=0.01 level. Continue analysis.

Matteo Metals 1st Emergence start date 09/03/03

File: d:\toxstat\1730101e.me8 Transform: 1/(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 15.80

Table Chi-square value = 16.81 (alpha = 0.01, df = 6)

Table Chi-square value = 12.59 (alpha = 0.05, df = 6)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

1ST EMERGENCE USING SITE 8 AS REFERENCE

Matteo Metals 1st Emergence start date 09/03/03

File: d:\toxstat\1730101e.me8

Transform: 1/(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	6	0.232	0.039	1.932
Within (Error)	28	0.561	0.020	
Total	34	0.793		

Critical F value = 2.45 (0.05,6,28)

Since $F < \text{Critical } F$ FAIL TO REJECT H_0 : All equal

Matteo Metals 1st Emergence start date 09/03/03

File: d:\toxstat\1730101e.me8

Transform: 1/(SQUARE ROOT(Y))

DUNNETT'S TEST

TABLE 1 OF 2

H_0 : Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Ref. Site 8	1.441	0.483		
2	Site 3	1.185	0.788	2.854	*
3	site 4	1.280	0.640	1.790	
4	Site 5	1.295	0.628	1.632	
5	Site 6	1.340	0.563	1.126	
6	Site 7	1.396	0.517	0.499	
7	Site 10	1.402	0.511	0.432	

Dunnett table value = 2.43 (1 Tailed Value, $P=0.05$, $df=24,6$)

Matteo Metals 1st Emergence start date 09/03/03

File: d:\toxstat\1730101e.me8

Transform: 1/(SQUARE ROOT(Y))

DUNNETT'S TEST

TABLE 2 OF 2

H_0 : Control < Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Ref. Site 8	5			
2	Site 3	5	-0.187	-38.6	-0.305
3	site 4	5	-0.187	-38.6	-0.157
4	Site 5	5	-0.187	-38.6	-0.145
5	Site 6	5	-0.187	-38.6	-0.080
6	Site 7	5	-0.187	-38.6	-0.034
7	Site 10	5	-0.187	-38.6	-0.028

1ST EMERGENCE USING SITE 8 AS REFERENCE

FILE: Matteo Metals 1st Emergence start date 09/03/03
 FILE: d:\toxstat\1730101e.me8
 TRANSFORM: 1/(SQUARE ROOT(Y)) NUMBER OF GROUPS: 7

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Ref. Site 8	1	0.4920	1.4257
1	Ref. Site 8	2	0.5080	1.4030
1	Ref. Site 8	3	0.4920	1.4257
1	Ref. Site 8	4	0.4920	1.4257
1	Ref. Site 8	5	0.4310	1.5232
2	Site 3	1	0.5080	1.4030
2	Site 3	2	1.0000	1.0000
2	Site 3	3	1.0000	1.0000
2	Site 3	4	1.0000	1.0000
2	Site 3	5	0.4310	1.5232
3	site 4	1	0.5080	1.4030
3	site 4	2	0.5230	1.3828
3	site 4	3	0.6000	1.2910
3	site 4	4	1.0000	1.0000
3	site 4	5	0.5690	1.3257
4	Site 5	1	0.5540	1.3435
4	Site 5	2	1.0000	1.0000
4	Site 5	3	0.5540	1.3435
4	Site 5	4	0.5080	1.4030
4	Site 5	5	0.5230	1.3828
5	Site 6	1	0.6620	1.2291
5	Site 6	2	0.5080	1.4030
5	Site 6	3	0.5230	1.3828
5	Site 6	4	0.4920	1.4257
5	Site 6	5	0.6310	1.2589
6	Site 7	1	0.4620	1.4712
6	Site 7	2	0.4620	1.4712
6	Site 7	3	0.5540	1.3435
6	Site 7	4	0.5080	1.4030
6	Site 7	5	0.6000	1.2910
7	Site 10	1	0.5380	1.3634
7	Site 10	2	0.5080	1.4030
7	Site 10	3	0.5230	1.3828
7	Site 10	4	0.4460	1.4974
7	Site 10	5	0.5380	1.3634

1ST EMERGENCE USING SITE 8 AS REFERENCE

Matteo Metals 1st Emergence start date 09/03/03

File: d:\toxstat\1730101E.MER

Transform: 1/(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Ref. Site 9	5	1.403	1.523	1.454
2	Site 3	5	1.000	1.523	1.185
3	site 4	5	1.000	1.403	1.280
4	Site 5	5	1.000	1.403	1.295
5	Site 6	5	1.229	1.426	1.340
6	Site 7	5	1.291	1.471	1.396
7	Site 10	5	1.363	1.497	1.402

Matteo Metals 1st Emergence start date 09/03/03

File: d:\toxstat\1730101E.MER

Transform: 1/(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Ref. Site 9	0.003	0.051	0.023	3.54
	Site 3	0.066	0.257	0.115	21.70
3	site 4	0.027	0.163	0.073	12.73
4	Site 5	0.028	0.167	0.075	12.87
5	Site 6	0.008	0.089	0.040	6.68
6	Site 7	0.006	0.079	0.035	5.68
7	Site 10	0.003	0.056	0.025	3.98

1ST EMERGENCE USING SITE 9 AS REFERENCE.

Matteo Metals 1st Emergence start date 09/03/03

File: d:\toxstat\1730101E.MER Transform: 1/(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.562

W = 0.957

Critical W (P = 0.05) (n = 35) = 0.934

Critical W (P = 0.01) (n = 35) = 0.910

Data PASS normality test at P=0.01 level. Continue analysis.

Matteo Metals 1st Emergence start date 09/03/03

File: d:\toxstat\1730101E.MER Transform: 1/(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 15.25

Table Chi-square value = 16.81 (alpha = 0.01, df = 6)

Table Chi-square value = 12.59 (alpha = 0.05, df = 6)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

1ST EMERGENCE USING SITE 9 AS REFERENCE

Matteo Metals 1st Emergence start date 09/03/03

File: d:\toxstat\1730101E.MER

Transform: 1/(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	6	0.247	0.041	2.054
Within (Error)	28	0.562	0.020	
Total	34	0.810		

Critical F value = 2.45 (0.05,6,28)

Since $F < \text{Critical } F$ FAIL TO REJECT H_0 : All equal

Matteo Metals 1st Emergence start date 09/03/03

File: d:\toxstat\1730101E.MER

Transform: 1/(SQUARE ROOT(Y))

DUNNETT'S TEST

TABLE 1 OF 2

H_0 : Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Ref. Site 9	1.454	0.474		
2	Site 3	1.185	0.788	3.003	*
3	site 4	1.280	0.640	1.940	
4	Site 5	1.295	0.628	1.783	
5	Site 6	1.340	0.563	1.277	
6	Site 7	1.396	0.517	0.651	
7	Site 10	1.402	0.511	0.584	

Dunnett table value = 2.43 (1 Tailed Value, $P=0.05$, $df=24,6$)

Matteo Metals 1st Emergence start date 09/03/03

File: d:\toxstat\1730101E.MER

Transform: 1/(SQUARE ROOT(Y))

DUNNETT'S TEST

TABLE 2 OF 2

H_0 : Control < Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Ref. Site 9	5			
2	Site 3	5	-0.181	-38.2	-0.314
3	site 4	5	-0.181	-38.2	-0.166
4	Site 5	5	-0.181	-38.2	-0.154
5	Site 6	5	-0.181	-38.2	-0.089
6	Site 7	5	-0.181	-38.2	-0.043
7	Site 10	5	-0.181	-38.2	-0.036

1ST EMERGENCE USING SITE 9 AS REFERENCE

TITLE: Matteo Metals 1st Emergence start date 09/03/03
FILE: d:\toxstat\1730101E\MER
TRANSFORM: 1/(SQUARE ROOT(Y)) NUMBER OF GROUPS: 7

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Ref. Site 9	1	0.5080	1.4030
1	Ref. Site 9	2	0.4310	1.5232
1	Ref. Site 9	3	0.5080	1.4030
1	Ref. Site 9	4	0.4620	1.4712
1	Ref. Site 9	5	0.4620	1.4712
2	Site 3	1	0.5080	1.4030
2	Site 3	2	1.0000	1.0000
2	Site 3	3	1.0000	1.0000
2	Site 3	4	1.0000	1.0000
2	Site 3	5	0.4310	1.5232
3	site 4	1	0.5080	1.4030
3	site 4	2	0.5230	1.3828
3	site 4	3	0.6000	1.2910
3	site 4	4	1.0000	1.0000
3	site 4	5	0.5690	1.3257
4	Site 5	1	0.5540	1.3435
4	Site 5	2	1.0000	1.0000
4	Site 5	3	0.5540	1.3435
4	Site 5	4	0.5080	1.4030
4	Site 5	5	0.5230	1.3828
5	Site 6	1	0.6620	1.2291
5	Site 6	2	0.5080	1.4030
5	Site 6	3	0.5230	1.3828
5	Site 6	4	0.4920	1.4257
5	Site 6	5	0.6310	1.2589
6	Site 7	1	0.4620	1.4712
6	Site 7	2	0.4620	1.4712
6	Site 7	3	0.5540	1.3435
6	Site 7	4	0.5080	1.4030
6	Site 7	5	0.6000	1.2910
7	Site 10	1	0.5380	1.3634
7	Site 10	2	0.5080	1.4030
7	Site 10	3	0.5230	1.3828
7	Site 10	4	0.4460	1.4974
7	Site 10	5	0.5380	1.3634

1ST EMERGENCE USING SITE 9 AS REFERENCE

STATISTICAL DATA FOR *Chironomus tentans*
EMERGENCE USING REFERENCE STATION 8

Matteo Metals Total Emergence @ Day 44 w/Ref 8
File: d:\toxstat\1730101t.e84 Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.643

W = 0.980

Critical W (P = 0.05) (n = 35) = 0.934

Critical W (P = 0.01) (n = 35) = 0.910

Data PASS normality test at P=0.01 level. Continue analysis.

Matteo Metals Total Emergence @ Day 44 w/Ref 8
File: d:\toxstat\1730101t.e84 Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 9.89

Table Chi-square value = 16.81 (alpha = 0.01, df = 6)

Table Chi-square value = 12.59 (alpha = 0.05, df = 6)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

EMERGENCE @ 44 DAYS USING REFERENCE SITE 8

Matteo Metals Total Emergence @ Day 44 w/Ref 8

File: d:\toxstat\1730101t.e84

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Ref. Site 8	5	0.705	0.866	0.769
2	Site 3	5	0.145	0.287	0.202
3	site 4	5	0.145	0.612	0.396
4	Site 5	5	0.145	0.705	0.389
5	Site 6	5	0.287	0.785	0.617
6	Site 7	5	0.412	0.705	0.555
7	Site 10	5	0.412	0.612	0.519

Matteo Metals Total Emergence @ Day 44 w/Ref 8

File: d:\toxstat\1730101t.e84

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Ref. Site 8	0.008	0.088	0.039	11.44
2	Site 3	0.006	0.078	0.035	38.55
3	site 4	0.035	0.186	0.083	46.96
4	Site 5	0.050	0.223	0.100	57.21
5	Site 6	0.046	0.213	0.095	34.58
6	Site 7	0.012	0.110	0.049	19.80
7	Site 10	0.005	0.071	0.032	13.71

EMERGENCE @ 44 DAYS USING REFERENCE SITE 8

Matteo Metals Total Emergence @ Day 44 w/Ref 8

File: d:\toxstat\1730101t.e84

Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	6	1.007	0.168	7.313
Within (Error)	28	0.643	0.023	
Total	34	1.650		

Critical F value = 2.45 (0.05,6,28)

Since F > Critical F REJECT Ho: All equal

Matteo Metals Total Emergence @ Day 44 w/Ref 8

File: d:\toxstat\1730101t.e84

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST - TABLE 1 OF 2

Ho: Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Ref. Site 8	0.769	0.484		
2	Site 3	0.202	0.032	5.925	*
3	site 4	0.396	0.164	3.899	*
4	Site 5	0.389	0.166	3.965	*
5	Site 6	0.617	0.350	1.587	
6	Site 7	0.555	0.282	2.235	
7	Site 10	0.519	0.248	2.614	*

Dunnett table value = 2.43 (1 Tailed Value, P=0.05, df=24,6)

Matteo Metals Total Emergence @ Day 44 w/Ref 8

File: d:\toxstat\1730101t.e84

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST - TABLE 2 OF 2

Ho: Control < Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Ref. Site 8	5			
2	Site 3	5	0.223	46.0	0.452
3	site 4	5	0.223	46.0	0.320
4	Site 5	5	0.223	46.0	0.318
5	Site 6	5	0.223	46.0	0.134
6	Site 7	5	0.223	46.0	0.202
7	Site 10	5	0.223	46.0	0.236

EMERGENCE @ 44 DAYS USING REFERENCE SITE 8

FILE: Matteo Metals Total Emergence @ Day 44 w/Ref 8

FILE: d:\toxstat\1730101t.e84

TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 7

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Ref. Site 8	1	0.4200	0.7051
1	Ref. Site 8	2	0.4200	0.7051
1	Ref. Site 8	3	0.4200	0.7051
1	Ref. Site 8	4	0.5800	0.8657
1	Ref. Site 8	5	0.5800	0.8657
2	Site 3	1	0.0800	0.2868
2	Site 3	2	0.0000	0.1448
2	Site 3	3	0.0000	0.1448
2	Site 3	4	0.0000	0.1448
2	Site 3	5	0.0800	0.2868
3	site 4	1	0.2500	0.5236
3	site 4	2	0.1600	0.4115
3	site 4	3	0.0800	0.2868
3	site 4	4	0.0000	0.1448
3	site 4	5	0.3300	0.6119
4	Site 5	1	0.4200	0.7051
4	Site 5	2	0.0000	0.1448
4	Site 5	3	0.0800	0.2868
4	Site 5	4	0.0800	0.2868
4	Site 5	5	0.2500	0.5236
5	Site 6	1	0.0800	0.2868
5	Site 6	2	0.4200	0.7051
5	Site 6	3	0.5000	0.7854
5	Site 6	4	0.5000	0.7854
5	Site 6	5	0.2500	0.5236
6	Site 7	1	0.3300	0.6119
6	Site 7	2	0.1600	0.4115
6	Site 7	3	0.2500	0.5236
6	Site 7	4	0.2500	0.5236
6	Site 7	5	0.4200	0.7051
7	Site 10	1	0.3300	0.6119
7	Site 10	2	0.2500	0.5236
7	Site 10	3	0.2500	0.5236
7	Site 10	4	0.1600	0.4115
7	Site 10	5	0.2500	0.5236

EMER. @ 44D REF 8

Matteo Metals Total Emergence @ Day 51 w/Ref 8

File: d:\toxstat\1730101t.807

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Ref. Site 8	5	0.705	1.146	0.910
2	Site 4	5	0.145	0.705	0.439
3	Site 5	5	0.145	0.705	0.389
4	Site 6	5	0.412	1.047	0.765
5	Site 7	5	0.524	1.047	0.700
6	Site 10	5	0.412	0.785	0.625

Matteo Metals Total Emergence @ Day 51 w/Ref 8

File: d:\toxstat\1730101t.807

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Ref. Site 8	0.033	0.183	0.082	20.11
2	Site 4	0.041	0.204	0.091	46.37
3	Site 5	0.050	0.223	0.100	57.21
4	Site 6	0.078	0.279	0.125	36.48
5	Site 7	0.042	0.204	0.091	29.21
6	Site 10	0.020	0.140	0.062	22.34

EMER. @ D 51 USING REF SITE 8

Matteo Metals Total Emergence @ Day 51 w/Ref 8

File: d:\toxstat\1730101t.807 Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 1.055

W = 0.960

Critical W (P = 0.05) (n = 30) = 0.927

Critical W (P = 0.01) (n = 30) = 0.900

Data PASS normality test at P=0.01 level. Continue analysis.

Matteo Metals Total Emergence @ Day 51 w/Ref 8

File: d:\toxstat\1730101t.807 Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 1.82

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)

Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

EMER. @ 51 DAYS USING REF SITE 8

Matteo Metals Total Emergence @ Day 51 w/Ref 8

File: d:\toxstat\1730101t.807

Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.976	0.195	4.441
Within (Error)	24	1.055	0.044	
Total	29	2.031		

Critical F value = 2.62 (0.05,5,24)

Since F > Critical F REJECT Ho: All equal

Matteo Metals Total Emergence @ Day 51 w/Ref 8

File: d:\toxstat\1730101t.807

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST - TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Ref. Site 8	0.910	0.616		
2	Site 4	0.439	0.198	3.549	*
3	Site 5	0.389	0.166	3.925	*
4	Site 6	0.765	0.482	1.095	
5	Site 7	0.700	0.416	1.583	
6	Site 10	0.625	0.348	2.147	

Dunnett table value = 2.36 (1 Tailed Value, P=0.05, df=24,5)

Matteo Metals Total Emergence @ Day 51 w/Ref 8

File: d:\toxstat\1730101t.807

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST - TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1.	Ref. Site 8	5			
2	Site 4	5	0.307	49.9	0.418
3	Site 5	5	0.307	49.9	0.450
4	Site 6	5	0.307	49.9	0.134
5	Site 7	5	0.307	49.9	0.200
6	Site 10	5	0.307	49.9	0.268

EMER. @ 51 DAYS USING REF. SITE 8

TITLE: Matteo Metals Total Emergence @ Day 51 w/Ref 8
 FILE: d:\toxstat\1730101t.807
 TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Ref. Site 8	1	0.5000	0.7854
1	Ref. Site 8	2	0.4200	0.7051
1	Ref. Site 8	3	0.5800	0.8657
1	Ref. Site 8	4	0.7500	1.0472
1	Ref. Site 8	5	0.8300	1.1458
2	Site 4	1	0.2500	0.5236
2	Site 4	2	0.1600	0.4115
2	Site 4	3	0.1600	0.4115
2	Site 4	4	0.0000	0.1448
2	Site 4	5	0.4200	0.7051
3	Site 5	1	0.4200	0.7051
3	Site 5	2	0.0000	0.1448
3	Site 5	3	0.0800	0.2868
3	Site 5	4	0.0800	0.2868
3	Site 5	5	0.2500	0.5236
4	Site 6	1	0.1600	0.4115
4	Site 6	2	0.4200	0.7051
4	Site 6	3	0.7500	1.0472
4	Site 6	4	0.7500	1.0472
4	Site 6	5	0.3300	0.6119
5	Site 7	1	0.3300	0.6119
5	Site 7	2	0.2500	0.5236
5	Site 7	3	0.7500	1.0472
5	Site 7	4	0.3300	0.6119
5	Site 7	5	0.4200	0.7051
6	Site 10	1	0.3300	0.6119
6	Site 10	2	0.5000	0.7854
6	Site 10	3	0.3300	0.6119
6	Site 10	4	0.1600	0.4115
6	Site 10	5	0.4200	0.7051

EMEL @ 51 DAYS USING REF SITE 8

Matteo Metals Total Emergence @ Day 58 w/Ref 8

File: d:\toxstat\1730101t.814

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Ref. Site 8	5	0.705	1.146	0.963
2	Site 4	5	0.145	0.705	0.439
3	Site 6	5	0.612	1.284	1.019
4	Site 7	5	0.524	1.146	0.754
5	Site 10	5	0.412	0.785	0.625

Matteo Metals Total Emergence @ Day 58 w/Ref 8

File: d:\toxstat\1730101t.814

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Ref. Site 8	0.027	0.164	0.073	16.99
2	Site 4	0.041	0.204	0.091	46.37
3	Site 6	0.083	0.287	0.129	28.22
4	Site 7	0.058	0.240	0.107	31.80
5	Site 10	0.020	0.140	0.062	22.34

EMERG. @ DAY 58 USING REF. SITE 8

Matteo Metals Total Emergence @ Day 58 w/Ref 8

File: d:\toxstat\1730101t.814

Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.912

W = 0.979

Critical W (P = 0.05) (n = 25) = 0.918

Critical W (P = 0.01) (n = 25) = 0.888

Data PASS normality test at P=0.01 level. Continue analysis.

Matteo Metals Total Emergence @ Day 58 w/Ref 8

File: d:\toxstat\1730101t.814

Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 2.35

Table Chi-square value = 13.28 (alpha = 0.01, df = 4)

Table Chi-square value = 9.49 (alpha = 0.05, df = 4)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

EMER. @ DAY 58 USING REF. SITE 8

Matteo Metals Total Emergence @ Day 58 w/Ref 8

File: d:\toxstat\1730101t.814

Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	4	1.146	0.286	6.285
Within (Error)	20	0.912	0.046	
Total	24	2.058		

Critical F value = 2.87 (0.05,4,20)

Since F > Critical F REJECT Ho: All equal

Matteo Metals Total Emergence @ Day 58 w/Ref 8

File: d:\toxstat\1730101t.814

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST

TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Ref. Site 8	0.963	0.668		
2	Site 4	0.439	0.198	3.879	*
3	Site 6	1.019	0.700	-0.411	
4	Site 7	0.754	0.466	1.546	
5	Site 10	0.625	0.348	2.503	*

Dunnett table value = 2.30

(1 Tailed Value, P=0.05, df=20,4)

Matteo Metals Total Emergence @ Day 58 w/Ref 8

File: d:\toxstat\1730101t.814

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST

TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Ref. Site 8	5			
2	Site 4	5	0.305	45.7	0.470
3	Site 6	5	0.305	45.7	-0.032
4	Site 7	5	0.305	45.7	0.202
5	Site 10	5	0.305	45.7	0.320

EMER. @ DAY 58 USING REF. SITE 8

TITLE: Matteo Metals Total Emergence @ Day 58 w/Ref 8

FILE: d:\toxstat\l730101t.814

TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 5

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Ref. Site 8	1	0.6700	0.9589
1	Ref. Site 8	2	0.4200	0.7051
1	Ref. Site 8	3	0.6700	0.9589
1	Ref. Site 8	4	0.7500	1.0472
1	Ref. Site 8	5	0.8300	1.1458
2	Site 4	1	0.2500	0.5236
2	Site 4	2	0.1600	0.4115
2	Site 4	3	0.1600	0.4115
2	Site 4	4	0.0000	0.1448
2	Site 4	5	0.4200	0.7051
3	Site 6	1	0.3300	0.6119
3	Site 6	2	0.5800	0.8657
3	Site 6	3	0.9200	1.2840
3	Site 6	4	0.7500	1.0472
3	Site 6	5	0.9200	1.2840
4	Site 7	1	0.3300	0.6119
4	Site 7	2	0.2500	0.5236
4	Site 7	3	0.8300	1.1458
4	Site 7	4	0.4200	0.7051
4	Site 7	5	0.5000	0.7854
5	Site 10	1	0.3300	0.6119
5	Site 10	2	0.5000	0.7854
5	Site 10	3	0.3300	0.6119
5	Site 10	4	0.1600	0.4115
5	Site 10	5	0.4200	0.7051

EMER. @ DAY 58 USING REF. SITE 8

Matteo Metals Total Emergence @ Day 65 w/Ref 8

File: d:\toxstat\1730101t.821

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Ref. Site 8	5	0.705	1.146	0.963
2	Site 6	5	0.785	1.426	1.100
3	Site 7	5	0.524	1.146	0.754
4	Site 10	5	0.412	0.785	0.676

Matteo Metals Total Emergence @ Day 65 w/Ref 8

File: d:\toxstat\1730101t.821

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Ref. Site 8	0.027	0.164	0.073	16.99
2	Site 6	0.065	0.256	0.114	23.25
3	Site 7	0.058	0.240	0.107	31.80
4	Site 10	0.027	0.166	0.074	24.53

EMER. @ DAY 65 USING REF. #8

Matteo Metals Total Emergence @ Day 65 w/Ref 8

File: d:\toxstat\1730101t.821

Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.709

W = 0.972

Critical W (P = 0.05) (n = 20) = 0.905

Critical W (P = 0.01) (n = 20) = 0.868

Data PASS normality test at P=0.01 level. Continue analysis.

Matteo Metals Total Emergence @ Day 65 w/Ref 8

File: d:\toxstat\1730101t.821

Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 1.20

Table Chi-square value = 11.34 (alpha = 0.01, df = 3)

Table Chi-square value = 7.81 (alpha = 0.05, df = 3)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

EMER. @ DAY 65 USING REF. SITE 8

Matteo Metals Total Emergence @ Day 65 w/Ref 8

File: d:\toxstat\1730101t.821

Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	3	0.563	0.188	4.239
Within (Error)	16	0.709	0.044	
Total	19	1.272		

Critical F value = 3.24 (0.05,3,16)

Since F > Critical F REJECT Ho: All equal

Matteo Metals Total Emergence @ Day 65 w/Ref 8

File: d:\toxstat\1730101t.821

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST - TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Ref. Site 8	0.963	0.668		
2	Site 6	1.100	0.768	-1.030	
3	Site 7	0.754	0.466	1.568	
4	Site 10	0.676	0.398	2.157	

Dunnett table value = 2.23 (1 Tailed Value, P=0.05, df=16,3)

Matteo Metals Total Emergence @ Day 65 w/Ref 8

File: d:\toxstat\1730101t.821

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST - TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Ref. Site 8	5			
2	Site 6	5	0.292	43.7	-0.100
3	Site 7	5	0.292	43.7	0.202
4	Site 10	5	0.292	43.7	0.270

EMER. @ DAY 65 USING REF. SITE 8

FILE: Matteo Metals Total Emergence @ Day 65 w/Ref 8
 FILE: d:\toxstat\1730101t.821
 TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 4

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Ref. Site 8	1	0.6700	0.9589
1	Ref. Site 8	2	0.4200	0.7051
1	Ref. Site 8	3	0.6700	0.9589
1	Ref. Site 8	4	0.7500	1.0472
1	Ref. Site 8	5	0.8300	1.1458
2	Site 6	1	0.5000	0.7854
2	Site 6	2	0.6700	0.9589
2	Site 6	3	0.9200	1.2840
2	Site 6	4	0.7500	1.0472
2	Site 6	5	1.0000	1.4260
3	Site 7	1	0.3300	0.6119
3	Site 7	2	0.2500	0.5236
3	Site 7	3	0.8300	1.1458
3	Site 7	4	0.4200	0.7051
3	Site 7	5	0.5000	0.7854
4	Site 10	1	0.5000	0.7854
4	Site 10	2	0.5000	0.7854
4	Site 10	3	0.3300	0.6119
4	Site 10	4	0.1600	0.4115
4	Site 10	5	0.5000	0.7854

EMER. @ DAY 65 USING REF. SITE 8

STATISTICAL DATA FOR *Chironomus tentans*
EMERGENCE USING REFERENCE STATION 9

Matteo Metals Total Emergence @ Day 44 w/Ref 9

File: d:\toxstat\1730101t.e94

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Ref. Site 9	5	0.524	0.959	0.736
2	Site 3	5	0.145	0.287	0.202
3	site 4	5	0.145	0.612	0.396
4	Site 5	5	0.145	0.705	0.389
5	Site 6	5	0.287	0.785	0.617
6	Site 7	5	0.412	0.705	0.555
7	Site 10	5	0.412	0.612	0.519

Matteo Metals Total Emergence @ Day 44 w/Ref 9

File: d:\toxstat\1730101t.e94

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Ref. Site 9	0.025	0.157	0.070	21.40
2	Site 3	0.006	0.078	0.035	38.55
3	site 4	0.035	0.186	0.083	46.96
4	Site 5	0.050	0.223	0.100	57.21
5	Site 6	0.046	0.213	0.095	34.58
6	Site 7	0.012	0.110	0.049	19.80
7	Site 10	0.005	0.071	0.032	13.71

EMER. @ 44 DAYS USING REF. SITE 9

Matteo Metals Total Emergence @ Day 44 w/Ref 9

File: d:\toxstat\1730101t.e94

Transform: ARC SINE(SQUARE ROOT(Y))

apiro - Wilk's test for normality

D = 0.711

W = 0.987

Critical W (P = 0.05) (n = 35) = 0.934

Critical W (P = 0.01) (n = 35) = 0.910

Data PASS normality test at P=0.01 level. Continue analysis.

Matteo Metals Total Emergence @ Day 44 w/Ref 9

File: d:\toxstat\1730101t.e94

Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 8.22

Table Chi-square value = 16.81 (alpha = 0.01, df = 6)

Table Chi-square value = 12.59 (alpha = 0.05, df = 6)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

EMER. @ 44 DAYS USING REF. SITE 9

Matteo Metals Total Emergence @ Day 44 w/Ref 9

File: d:\toxstat\1730101t.e94

Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	6	0.919	0.153	6.031
Within (Error)	28	0.711	0.025	
Total	34	1.629		

Critical F value = 2.45 (0.05,6,28)

Since F > Critical F REJECT Ho: All equal

Matteo Metals Total Emergence @ Day 44 w/Ref 9

File: d:\toxstat\1730101t.e94

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Ref. Site 9	0.736	0.452		
2	Site 3	0.202	0.032	5.299	*
3	site 4	0.396	0.164	3.373	*
4	Site 5	0.389	0.166	3.435	*
5	Site 6	0.617	0.350	1.174	
6	Site 7	0.555	0.282	1.791	
7	Site 10	0.519	0.248	2.151	

Dunnett table value = 2.43 (1 Tailed Value, P=0.05, df=24,6)

Matteo Metals Total Emergence @ Day 44 w/Ref 9

File: d:\toxstat\1730101t.e94

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Ref. Site 9	5			
2	Site 3	5	0.228	50.5	0.420
3	site 4	5	0.228	50.5	0.288
4	Site 5	5	0.228	50.5	0.286
5	Site 6	5	0.228	50.5	0.102
6	Site 7	5	0.228	50.5	0.170
7	Site 10	5	0.228	50.5	0.204

EMER @ 44 DAYS USING REF SITE 9

TITLE: Matteo Metals Total Emergence @ Day 44 w/Ref 9
 FILE: d:\toxstat\1730101t.e94
 TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 7

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Ref. Site 9	1	0.2500	0.5236
1	Ref. Site 9	2	0.6700	0.9589
1	Ref. Site 9	3	0.4200	0.7051
1	Ref. Site 9	4	0.5000	0.7854
1	Ref. Site 9	5	0.4200	0.7051
2	Site 3	1	0.0800	0.2868
2	Site 3	2	0.0000	0.1448
2	Site 3	3	0.0000	0.1448
2	Site 3	4	0.0000	0.1448
2	Site 3	5	0.0800	0.2868
3	site 4	1	0.2500	0.5236
3	site 4	2	0.1600	0.4115
3	site 4	3	0.0800	0.2868
3	site 4	4	0.0000	0.1448
3	site 4	5	0.3300	0.6119
4	Site 5	1	0.4200	0.7051
4	Site 5	2	0.0000	0.1448
4	Site 5	3	0.0800	0.2868
4	Site 5	4	0.0800	0.2868
4	Site 5	5	0.2500	0.5236
5	Site 6	1	0.0800	0.2868
5	Site 6	2	0.4200	0.7051
5	Site 6	3	0.5000	0.7854
5	Site 6	4	0.5000	0.7854
5	Site 6	5	0.2500	0.5236
6	Site 7	1	0.3300	0.6119
6	Site 7	2	0.1600	0.4115
6	Site 7	3	0.2500	0.5236
6	Site 7	4	0.2500	0.5236
6	Site 7	5	0.4200	0.7051
7	Site 10	1	0.3300	0.6119
7	Site 10	2	0.2500	0.5236
7	Site 10	3	0.2500	0.5236
7	Site 10	4	0.1600	0.4115
7	Site 10	5	0.2500	0.5236

EMER. @ 44 DAYS USING REF. SITE 9

Matteo Metals Total Emergence @ Day 51 w/Ref 9

File: d:\toxstat\1730101t.907

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Ref. Site 9	5	0.705	1.284	0.885
2	Site 4	5	0.145	0.705	0.439
3	Site 5	5	0.145	0.705	0.389
4	Site 6	5	0.412	1.047	0.765
5	Site 7	5	0.524	1.047	0.700
6	Site 10	5	0.412	0.785	0.625

Matteo Metals Total Emergence @ Day 51 w/Ref 9

File: d:\toxstat\1730101t.907

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Ref. Site 9	0.053	0.230	0.103	26.00
	Site 4	0.041	0.204	0.091	46.37
	Site 5	0.050	0.223	0.100	57.21
4	Site 6	0.078	0.279	0.125	36.48
5	Site 7	0.042	0.204	0.091	29.21
6	Site 10	0.020	0.140	0.062	22.34

EMER @ DAY 51 USING REF. SITE 9

Matteo Metals Total Emergence @ Day 51 w/Ref 9

File: d:\toxstat\1730101t.907

Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 1.133

W = 0.948

Critical W (P = 0.05) (n = 30) = 0.927

Critical W (P = 0.01) (n = 30) = 0.900

Data PASS normality test at P=0.01 level. Continue analysis.

Matteo Metals Total Emergence @ Day 51 w/Ref 9

File: d:\toxstat\1730101t.907

Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 1.71

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)

Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

EMER. @ 51 DAYS USING REF. SITE 9

Matteo Metals Total Emergence @ Day 51 w/Ref 9

File: d:\toxstat\1730101t.907

Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.911	0.182	3.862
Within (Error)	24	1.133	0.047	
Total	29	2.044		

Critical F value = 2.62 (0.05,5,24)

Since $F > \text{Critical } F$ REJECT H_0 : All equal

Matteo Metals Total Emergence @ Day 51 w/Ref 9

File: d:\toxstat\1730101t.907

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST - TABLE 1 OF 2

H_0 : Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Ref. Site 9	0.885	0.584		
2	Site 4	0.439	0.198	3.245	*
3	Site 5	0.389	0.166	3.608	*
4	Site 6	0.765	0.482	0.877	
5	Site 7	0.700	0.416	1.348	
6	Site 10	0.625	0.348	1.892	

Dunnett table value = 2.36 (1 Tailed Value, $P=0.05$, $df=24,5$)

Matteo Metals Total Emergence @ Day 51 w/Ref 9

File: d:\toxstat\1730101t.907

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST - TABLE 2 OF 2

H_0 : Control < Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Ref. Site 9	5			
2	Site 4	5	0.316	54.1	0.386
3	Site 5	5	0.316	54.1	0.418
4	Site 6	5	0.316	54.1	0.102
5	Site 7	5	0.316	54.1	0.168
6	Site 10	5	0.316	54.1	0.236

EMER. @ 51 DAYS USING REF. SITE 9

TITLE: Matteo Metals Total Emergence @ Day 51 w/Ref 9

FILE: d:\toxstat\1730101t.907

TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Ref. Site 9	1	0.4200	0.7051
1	Ref. Site 9	2	0.9200	1.2840
1	Ref. Site 9	3	0.5000	0.7854
1	Ref. Site 9	4	0.5000	0.7854
1	Ref. Site 9	5	0.5800	0.8657
2	Site 4	1	0.2500	0.5236
2	Site 4	2	0.1600	0.4115
2	Site 4	3	0.1600	0.4115
2	Site 4	4	0.0000	0.1448
2	Site 4	5	0.4200	0.7051
3	Site 5	1	0.4200	0.7051
3	Site 5	2	0.0000	0.1448
3	Site 5	3	0.0800	0.2868
3	Site 5	4	0.0800	0.2868
3	Site 5	5	0.2500	0.5236
4	Site 6	1	0.1600	0.4115
4	Site 6	2	0.4200	0.7051
4	Site 6	3	0.7500	1.0472
4	Site 6	4	0.7500	1.0472
4	Site 6	5	0.3300	0.6119
5	Site 7	1	0.3300	0.6119
5	Site 7	2	0.2500	0.5236
5	Site 7	3	0.7500	1.0472
5	Site 7	4	0.3300	0.6119
5	Site 7	5	0.4200	0.7051
6	Site 10	1	0.3300	0.6119
6	Site 10	2	0.5000	0.7854
6	Site 10	3	0.3300	0.6119
6	Site 10	4	0.1600	0.4115
6	Site 10	5	0.4200	0.7051

EMER. @ 51 DAYS USING REF. SITE 9

Matteo Metals total Emergence @58 days w/Ref 9

File: d:\toxstat\1730101.914

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Ref. Site 9	5	0.705	1.284	0.972
2	Site 4	5	0.145	0.705	0.439
3	Site 6	5	0.612	1.284	1.019
4	Site 7	5	0.524	1.146	0.754
5	Site 10	5	0.412	0.785	0.625

Matteo Metals total Emergence @58 days w/Ref 9

File: d:\toxstat\1730101.914

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Ref. Site 9	0.046	0.215	0.096	22.17
2	Site 4	0.041	0.204	0.091	46.37
3	Site 6	0.083	0.287	0.129	28.22
4	Site 7	0.058	0.240	0.107	31.80
5	Site 10	0.020	0.140	0.062	22.34

EMER @ DAY 58 USING REF. SITE 9

Matteo Metals total Emergence @58 days w/Ref 9

File: d:\toxstat\1730101.914 Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.990

W = 0.977

Critical W (P = 0.05) (n = 25) = 0.918

Critical W (P = 0.01) (n = 25) = 0.888

Data PASS normality test at P=0.01 level. Continue analysis.

Matteo Metals total Emergence @58 days w/Ref 9

File: d:\toxstat\1730101.914 Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 1.86

Table Chi-square value = 13.28 (alpha = 0.01, df = 4)

Table Chi-square value = 9.49 (alpha = 0.05, df = 4)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

EMER. @ DAY 58 USING REF. SITE 9

Matteo Metals total Emergence @58 days w/Ref 9

File: d:\toxstat\1730101.914

Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	4	1.165	0.291	5.880
Within (Error)	20	0.990	0.050	
Total	24	2.155		

Critical F value = 2.87 (0.05,4,20)

Since $F > \text{Critical } F$ REJECT H_0 : All equal

Matteo Metals total Emergence @58 days w/Ref 9

File: d:\toxstat\1730101.914

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST

TABLE 1 OF 2

H_0 : Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Ref. Site 9	0.972	0.668		
2	Site 4	0.439	0.198	3.786	*
3	Site 6	1.019	0.700	-0.330	
4	Site 7	0.754	0.466	1.548	
5	Site 10	0.625	0.348	2.466	*

Dunnett table value = 2.30 (1 Tailed Value, $P=0.05$, $df=20,4$)

Matteo Metals total Emergence @58 days w/Ref 9

File: d:\toxstat\1730101.914

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST

TABLE 2 OF 2

H_0 : Control < Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Ref. Site 9	5			
2	Site 4	5	0.318	47.6	0.470
3	Site 6	5	0.318	47.6	-0.032
4	Site 7	5	0.318	47.6	0.202
5	Site 10	5	0.318	47.6	0.320

EMER @ DAY 58 USING REF. SITE 9

TITLE: Matteo Metals total Emergence @58 days w/Ref 9
E: d:\toxstat\1730101.914
TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 5

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Ref. Site 9	1	0.4200	0.7051
1	Ref. Site 9	2	0.9200	1.2840
1	Ref. Site 9	3	0.6700	0.9589
1	Ref. Site 9	4	0.5800	0.8657
1	Ref. Site 9	5	0.7500	1.0472
2	Site 4	1	0.2500	0.5236
2	Site 4	2	0.1600	0.4115
2	Site 4	3	0.1600	0.4115
2	Site 4	4	0.0000	0.1448
2	Site 4	5	0.4200	0.7051
3	Site 6	1	0.3300	0.6119
3	Site 6	2	0.5800	0.8657
3	Site 6	3	0.9200	1.2840
3	Site 6	4	0.7500	1.0472
3	Site 6	5	0.9200	1.2840
4	Site 7	1	0.3300	0.6119
4	Site 7	2	0.2500	0.5236
4	Site 7	3	0.8300	1.1458
4	Site 7	4	0.4200	0.7051
4	Site 7	5	0.5000	0.7854
5	Site 10	1	0.3300	0.6119
5	Site 10	2	0.5000	0.7854
5	Site 10	3	0.3300	0.6119
5	Site 10	4	0.1600	0.4115
5	Site 10	5	0.4200	0.7051

EMER. @ DAY 58 USING REF. SITE 9

Matteo Metals Total Emergence @ Day 65 w/Ref 9

File: d:\toxstat\1730101.921

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Ref. Site 9	5	0.866	1.284	1.024
2	Site 6	5	0.785	1.426	1.100
3	Site 7	5	0.524	1.146	0.754
4	Site 10	5	0.412	0.785	0.676

Matteo Metals Total Emergence @ Day 65 w/Ref 9

File: d:\toxstat\1730101.921

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Ref. Site 9	0.034	0.185	0.083	18.06
2	Site 6	0.065	0.256	0.114	23.25
3	Site 7	0.058	0.240	0.107	31.80
	Site 10	0.027	0.166	0.074	24.53

EMER. @ DAY 65 USING REF SITE 9

Matteo Metals Total Emergence @ Day 65 w/Ref 9

File: d:\toxstat\1730101.921 Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 0.739

W = 0.964

Critical W (P = 0.05) (n = 20) = 0.905

Critical W (P = 0.01) (n = 20) = 0.868

Data PASS normality test at P=0.01 level. Continue analysis.

Matteo Metals Total Emergence @ Day 65 w/Ref 9

File: d:\toxstat\1730101.921 Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 0.90

Table Chi-square value = 11.34 (alpha = 0.01, df = 3)

Table Chi-square value = 7.81 (alpha = 0.05, df = 3)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

EMER. @ DAY 65 USING REF. SITE 9

Matteo Metals Total Emergence @ Day 65 w/Ref 9

File: d:\toxstat\1730101.921

Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	3	0.632	0.211	4.563
Within (Error)	16	0.739	0.046	
Total	19	1.371		

Critical F value = 3.24 (0.05,3,16)
 Since $F > \text{Critical } F$ REJECT H_0 : All equal

Matteo Metals Total Emergence @ Day 65 w/Ref 9

File: d:\toxstat\1730101.921

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST - TABLE 1 OF 2

H_0 : Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Ref. Site 9	1.024	0.716		
2	Site 6	1.100	0.768	-0.561	
3	Site 7	0.754	0.466	1.984	
4	Site 10	0.676	0.398	2.562	*

Dunnett table value = 2.23 (1 Tailed Value, $P=0.05$, $df=16,3$)

Matteo Metals Total Emergence @ Day 65 w/Ref 9

File: d:\toxstat\1730101.921

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST - TABLE 2 OF 2

H_0 : Control < Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Ref. Site 9	5			
2	Site 6	5	0.294	41.0	-0.052
3	Site 7	5	0.294	41.0	0.250
4	Site 10	5	0.294	41.0	0.318

EMER. @ DAY 65 USING REF. SITE 9

FILE: Matteo Metals Total Emergence @ Day 65 w/Ref 9
E: d:\toxstat\1730101.921
TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 4

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Ref. Site 9	1	0.5800	0.8657
1	Ref. Site 9	2	0.9200	1.2840
1	Ref. Site 9	3	0.6700	0.9589
1	Ref. Site 9	4	0.5800	0.8657
1	Ref. Site 9	5	0.8300	1.1458
2	Site 6	1	0.5000	0.7854
2	Site 6	2	0.6700	0.9589
2	Site 6	3	0.9200	1.2840
2	Site 6	4	0.7500	1.0472
2	Site 6	5	1.0000	1.4260
3	Site 7	1	0.3300	0.6119
3	Site 7	2	0.2500	0.5236
3	Site 7	3	0.8300	1.1458
3	Site 7	4	0.4200	0.7051
3	Site 7	5	0.5000	0.7854
4	Site 10	1	0.5000	0.7854
4	Site 10	2	0.5000	0.7854
4	Site 10	3	0.3300	0.6119
4	Site 10	4	0.1600	0.4115
4	Site 10	5	0.5000	0.7854

EMER. @ DAY 65 USING REF. SITE 9

STATISTICAL DATA FOR *Chironomus tentans*

TOTAL SURVIVAL

WITH CONTROL & REFERENCE SEDIMENTS

Table IV: Total survival *C. tentans* 65 Day Emergence Test

Site ID	Total Survival - %	References Significant VS. Control?	Sites Significant VS. Site 8?	Sites Significant VS. Site 9?
Control	88.3	-	N/A ¹	N/A ¹
1 - Ref	25.0	YES	N/A ²	N/A ²
2 - Ref	40.0	YES	N/A ²	N/A ²
3	50.0	62.8	YES	YES
4	21.7	56.3	No	YES
5	81.7	51.7	No	No
6	81.7	48.3	No	No
7	46.7	47.4	No	YES
8 - Ref	68.3	No	-	N/A ²
9 - Ref	80.0	No	N/A ²	-
10 - Ref	55.0	YES	No ³	No ³

1 - Control not included in Site analyses

2 - References not included in Site analyses

3 - Site 10 include as Site sample due to possible contamination

Matteo Metals Total Survival Control vs. Reference Sites

File: d:\toxstat\173101Co.Com

Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	2.037	0.407	8.328
Within (Error)	24	1.174	0.049	
Total	29	3.212		

Critical F value = 2.62 (0.05,5,24)

Since $F > \text{Critical } F$ REJECT H_0 : All equal

Matteo Metals Total Survival Control vs. Reference Sites

File: d:\toxstat\173101Co.Com

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST

TABLE 1 OF 2

H_0 : Control < Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Control	1.231	0.883		
2	Site 1	0.473	0.250	5.415	*
3	Site 2	0.657	0.400	4.100	*
4	Site 8	0.989	0.683	1.732	
5	Site 9	1.116	0.800	0.820	
6	Site 10	0.836	0.550	2.822	*

Dunnett table value = 2.36 (1 Tailed Value, $P=0.05$, $df=24,5$)

Matteo Metals Total Survival Control vs. Reference Sites

File: d:\toxstat\173101Co.Com

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST

TABLE 2 OF 2

H_0 : Control < Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Control	5			
2	Site 1	5	0.275	31.1	0.633
3	Site 2	5	0.275	31.1	0.483
4	Site 8	5	0.275	31.1	0.200
5	Site 9	5	0.275	31.1	0.083
6	Site 10	5	0.275	31.1	0.333

TOTAL SURV. COMPARISON CONTROL VS. REFERENCE SITES

Matteo Metals Total Survival Control vs. Reference Sites

File: d:\toxstat\173101Co.Com

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Control	5	1.150	1.426	1.231
2	Site 1	5	0.145	0.955	0.473
3	Site 2	5	0.145	0.869	0.657
4	Site 8	5	0.702	1.278	0.989
5	Site 9	5	0.955	1.278	1.116
6	Site 10	5	0.785	0.955	0.836

Matteo Metals Total Survival Control vs. Reference Sites

File: d:\toxstat\173101Co.Com

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Control	0.015	0.122	0.055	9.93
2	Site 1	0.126	0.355	0.159	74.90
3	Site 2	0.086	0.293	0.131	44.50
4	Site 8	0.047	0.216	0.097	21.88
5	Site 9	0.015	0.122	0.054	10.89
6	Site 10	0.006	0.076	0.034	9.07

TOTAL SURV. COMPARISON CONTROL VS. REFERENCE SITES

Matteo Metals Total Survival Control vs. Reference Sites

File: d:\toxstat\173101Co.Com Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 1.174

W = 0.972

Critical W (P = 0.05) (n = 30) = 0.927

Critical W (P = 0.01) (n = 30) = 0.900

Data PASS normality test at P=0.01 level. Continue analysis.

Matteo Metals Total Survival Control vs. Reference Sites

File: d:\toxstat\173101Co.Com Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 11.18

Table Chi-square value = 15.09 (alpha = 0.01, df = 5)

Table Chi-square value = 11.07 (alpha = 0.05, df = 5)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

TOTAL SURV. COMPARISON CONTROL VS. REFERENCE SITES

TITLE: Matteo Metals Total Survival Control vs. Reference Sites
 FILE: d:\toxstat\l73101Co.Com
 TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Control	1	0.8333	1.1502
1	Control	2	1.0000	1.4260
1	Control	3	0.9166	1.2778
1	Control	4	0.8333	1.1502
1	Control	5	0.8333	1.1502
2	Site 1	1	0.6666	0.9552
2	Site 1	2	0.1666	0.4204
2	Site 1	3	0.4166	0.7016
2	Site 1	4	0.0000	0.1448
2	Site 1	5	0.0000	0.1448
3	Site 2	1	0.5833	0.8691
3	Site 2	2	0.5000	0.7854
3	Site 2	3	0.0000	0.1448
3	Site 2	4	0.4166	0.7016
3	Site 2	5	0.5000	0.7854
4	Site 8	1	0.5833	0.8691
4	Site 8	2	0.4166	0.7016
4	Site 8	3	0.7500	1.0472
4	Site 8	4	0.7500	1.0472
4	Site 8	5	0.9166	1.2778
5	Site 9	1	0.7500	1.0472
5	Site 9	2	0.9166	1.2778
5	Site 9	3	0.6666	0.9552
5	Site 9	4	0.8333	1.1502
5	Site 9	5	0.8333	1.1502
6	Site 10	1	0.5000	0.7854
6	Site 10	2	0.6666	0.9552
6	Site 10	3	0.5833	0.8691
6	Site 10	4	0.5000	0.7854
6	Site 10	5	0.5000	0.7854

TOTAL SURV. COMPARISON CONTROL VS. REFERENCE SITES

Matteo Metals Total Survival Using Reference Site 8

File: d:\toxstat\173101to.ts8

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Reference 8	5	0.702	1.278	0.989
2	Site 3	5	0.615	0.955	0.786
3	Site 4	5	0.293	0.702	0.472
4	Site 5	5	0.785	1.426	1.167
5	Site 6	5	0.955	1.426	1.162
6	Site 7	5	0.524	1.150	0.755
7	Site 10	5	0.785	0.955	0.836

Matteo Metals Total Survival Using Reference Site 8

File: d:\toxstat\173101to.ts8

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Reference 8	0.047	0.216	0.097	21.88
	Site 3	0.025	0.159	0.071	20.18
3	Site 4	0.023	0.152	0.068	32.29
4	Site 5	0.074	0.271	0.121	23.25
5	Site 6	0.060	0.244	0.109	20.99
6	Site 7	0.058	0.241	0.108	31.96
7	Site 10	0.006	0.076	0.034	9.07

TOTAL SURVIVAL USING REF. SITE 8

Matteo Metals Total Survival Using Reference Site 8

File: d:\toxstat\173101to.ts8

Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 1.169

W = 0.966

Critical W (P = 0.05) (n = 35) = 0.934

Critical W (P = 0.01) (n = 35) = 0.910

Data PASS normality test at P=0.01 level. Continue analysis.

Matteo Metals Total Survival Using Reference Site 8

File: d:\toxstat\173101to.ts8

Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 6.24

Table Chi-square value = 16.81 (alpha = 0.01, df = 6)

Table Chi-square value = 12.59 (alpha = 0.05, df = 6)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

TOTAL SURVIVAL USING REF. SITE 8

Matteo Metals Total Survival Using Reference Site 8

File: d:\toxstat\173101to.ts8

Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	6	1.833	0.306	7.317
Within (Error)	28	1.169	0.042	
Total	34	3.002		

Critical F value = 2.45 (0.05,6,28)

Since F > Critical F REJECT Ho: All equal

Matteo Metals Total Survival Using Reference Site 8

File: d:\toxstat\173101to.ts8

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST - TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Reference 8	0.989	0.683		
2	Site 3	0.786	0.500	1.569	
3	Site 4	0.472	0.217	3.999	*
4	Site 5	1.167	0.817	-1.380	
5	Site 6	1.162	0.817	-1.341	
6	Site 7	0.755	0.467	1.806	
7	Site 10	0.836	0.550	1.180	

Dunnett table value = 2.43 (1 Tailed Value, P=0.05, df=24,6)

Matteo Metals Total Survival Using Reference Site 8

File: d:\toxstat\173101to.ts8

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST - TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Reference 8	5			
2	Site 3	5	0.308	45.0	0.183
3	Site 4	5	0.308	45.0	0.467
4	Site 5	5	0.308	45.0	-0.133
5	Site 6	5	0.308	45.0	-0.133
6	Site 7	5	0.308	45.0	0.217
7	Site 10	5	0.308	45.0	0.133

TOTAL SURVIVAL USING REF. SITE 8

TITLE: Matteo Metals Total Survival Using Reference Site 8

FILE: d:\toxstat\l73101to.ts8

TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 7

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Reference 8	1	0.5833	0.8691
1	Reference 8	2	0.4166	0.7016
1	Reference 8	3	0.7500	1.0472
1	Reference 8	4	0.7500	1.0472
1	Reference 8	5	0.9166	1.2778
2	Site 3	1	0.4166	0.7016
2	Site 3	2	0.6666	0.9552
2	Site 3	3	0.6666	0.9552
2	Site 3	4	0.4166	0.7016
2	Site 3	5	0.3333	0.6154
3	Site 4	1	0.2500	0.5236
3	Site 4	2	0.1666	0.4204
3	Site 4	3	0.1666	0.4204
3	Site 4	4	0.0833	0.2928
3	Site 4	5	0.4166	0.7016
4	Site 5	1	1.0000	1.4260
4	Site 5	2	0.8333	1.1502
4	Site 5	3	0.7500	1.0472
4	Site 5	4	1.0000	1.4260
4	Site 5	5	0.5000	0.7854
5	Site 6	1	0.6666	0.9552
5	Site 6	2	0.6666	0.9552
5	Site 6	3	1.0000	1.4260
5	Site 6	4	0.7500	1.0472
5	Site 6	5	1.0000	1.4260
6	Site 7	1	0.3333	0.6151
6	Site 7	2	0.2500	0.5236
6	Site 7	3	0.8333	1.1502
6	Site 7	4	0.4166	0.7016
6	Site 7	5	0.5000	0.7854
7	Site 10	1	0.5000	0.7854
7	Site 10	2	0.6666	0.9552
7	Site 10	3	0.5833	0.8691
7	Site 10	4	0.5000	0.7854
7	Site 10	5	0.5000	0.7854

TOTAL SURVIVAL USING REF. SITE 8

Matteo Metals Total Survival Using Reference Site 9

File: d:\toxstat\173101to.ts9

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Reference 9	5	0.955	1.278	1.116
2	Site 3	5	0.615	0.955	0.786
3	Site 4	5	0.293	0.702	0.472
4	Site 5	5	0.785	1.426	1.167
5	Site 6	5	0.955	1.426	1.162
6	Site 7	5	0.524	1.150	0.755
7	Site 10	5	0.785	0.955	0.836

Matteo Metals Total Survival Using Reference Site 9

File: d:\toxstat\173101to.ts9

Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Reference 9	0.015	0.122	0.054	10.89
2	Site 3	0.025	0.159	0.071	20.18
3	Site 4	0.023	0.152	0.068	32.29
4	Site 5	0.074	0.271	0.121	23.25
5	Site 6	0.060	0.244	0.109	20.99
6	Site 7	0.058	0.241	0.108	31.96
7	Site 10	0.006	0.076	0.034	9.07

TOTAL SURVIVAL USING REF. SITE 9

Matteo Metals Total Survival Using Reference Site 9

File: d:\toxstat\173101to.ts9

Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 1.041

W = 0.965

Critical W (P = 0.05) (n = 35) = 0.934

Critical W (P = 0.01) (n = 35) = 0.910

Data PASS normality test at P=0.01 level. Continue analysis.

Matteo Metals Total Survival Using Reference Site 9

File: d:\toxstat\173101to.ts9

Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance

Calculated B1 statistic = 7.48

Table Chi-square value = 16.81 (alpha = 0.01, df = 6)

Table Chi-square value = 12.59 (alpha = 0.05, df = 6)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

TOTAL SURVIVAL USING REF. SITE 9

Matteo Metals Total Survival Using Reference Site 9

File: d:\toxstat\173101to.ts9

Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	6	2.040	0.340	9.146
Within (Error)	28	1.041	0.037	
Total	34	3.081		

Critical F value = 2.45 (0.05,6,28)

Since F > Critical F REJECT Ho: All equal

Matteo Metals Total Survival Using Reference Site 9

File: d:\toxstat\173101to.ts9

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST

TABLE 1 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Reference 9	1.116	0.800		
2	Site 3	0.786	0.500	2.709	*
3	Site 4	0.472	0.217	5.284	*
4	Site 5	1.167	0.817	-0.417	
5	Site 6	1.162	0.817	-0.375	
6	Site 7	0.755	0.467	2.960	*
7	Site 10	0.836	0.550	2.296	

Dunnett table value = 2.43 (1 Tailed Value, P=0.05, df=24,6)

Matteo Metals Total Survival Using Reference Site 9

File: d:\toxstat\173101to.ts9

Transform: ARC SINE(SQUARE ROOT(Y))

DUNNETT'S TEST

TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Reference 9	5			
2	Site 3	5	0.273	34.1	0.300
3	Site 4	5	0.273	34.1	0.583
4	Site 5	5	0.273	34.1	-0.017
5	Site 6	5	0.273	34.1	-0.017
6	Site 7	5	0.273	34.1	0.333
7	Site 10	5	0.273	34.1	0.250

TOTAL SURVIVAL USING REF. SITE 9

TITLE: Matteo Metals Total Survival Using Reference Site 9

FILE: d:\toxstat\173101to.ts9

TRANSFORM: ARC SINE(SQUARE ROOT(Y))

NUMBER OF GROUPS: 7

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Reference 9	1	0.7500	1.0472
1	Reference 9	2	0.9166	1.2778
1	Reference 9	3	0.6666	0.9552
1	Reference 9	4	0.8333	1.1502
1	Reference 9	5	0.8333	1.1502
2	Site 3	1	0.4166	0.7016
2	Site 3	2	0.6666	0.9552
2	Site 3	3	0.6666	0.9552
2	Site 3	4	0.4166	0.7016
2	Site 3	5	0.3333	0.6154
3	Site 4	1	0.2500	0.5236
3	Site 4	2	0.1666	0.4204
3	Site 4	3	0.1666	0.4204
3	Site 4	4	0.0833	0.2928
3	Site 4	5	0.4166	0.7016
4	Site 5	1	1.0000	1.4260
4	Site 5	2	0.8333	1.1502
4	Site 5	3	0.7500	1.0472
4	Site 5	4	1.0000	1.4260
4	Site 5	5	0.5000	0.7854
5	Site 6	1	0.6666	0.9552
5	Site 6	2	0.6666	0.9552
5	Site 6	3	1.0000	1.4260
5	Site 6	4	0.7500	1.0472
5	Site 6	5	1.0000	1.4260
6	Site 7	1	0.3333	0.6151
6	Site 7	2	0.2500	0.5236
6	Site 7	3	0.8333	1.1502
6	Site 7	4	0.4166	0.7016
6	Site 7	5	0.5000	0.7854
7	Site 10	1	0.5000	0.7854
7	Site 10	2	0.6666	0.9552
7	Site 10	3	0.5833	0.8691
7	Site 10	4	0.5000	0.7854
7	Site 10	5	0.5000	0.7854

TOTAL SURVIVAL USING REF. SITE 9

CHAIN OF CUSTODY DOCUMENTATION

208 South Park Drive, Suite 1, Colchester, VT 05446 Tel: (802) 655-1203

2

JOB: N101

THE UNIVERSITY OF CHICAGO

ГМА МУ. 16020331640

R. UC

STL KDISON

KLARKE, RICHARD W. JR.

71-8230 (0700)



Severn Trent Laboratories, Inc.

208 South Park Drive, Suite 1, Colchester, VT 05446 Tel: (802) 655-1203

CHAIN OF CUSTODY RECORD

Report to: Company: <u>Louis Berger Group</u> Address: <u>30 Vreeland Road, Bldg A</u> <u>Florham Park, NJ 07932</u> Contact: <u>Tom Tanico</u> Phone: <u>973-678-1960 x608</u> Fax: <u>973-676-3564</u> Contract/ Quote: _____				Invoice to: Company: <u>Louis Berger Group</u> Address: <u>30 Vreeland Road, Bldg A</u> <u>Florham Park, NJ 07932</u> Contact: <u>Tom Tanico</u> Phone: <u>973-678-1960</u> Fax: <u>973-676-3564</u>				ANALYSIS REQUESTED <div style="border: 1px solid black; padding: 5px; transform: rotate(-90deg); transform-origin: center;"> Toxicity PCB, Lead, TOC, PH Grain Size </div>				<div style="border: 1px solid black; padding: 5px;"> Lab Use Only Due Date: _____ Temp. of coolers when received (C°): <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td> </tr> </table> Custody Seal N/Y Intact N/Y Screened For Radioactivity <input type="checkbox"/> </div>				1	2	3	4
1	2	3	4																
Sampler's Name <u>Brian Janikowski</u>				Sampler's Signature <u>Brian Janikowski</u>				JOB: N049											
Proj. No. <u>IV-7962</u>		Project Name <u>Matted Iron & Metal</u>		No./Type of Containers² <u>24/1 Liter G</u> <u>12/16 oz A</u>															
Matrix¹	Date	Time	Cmp	Gfab	Identifying Marks of Sample(s)	VOA	A/G 1 Lt.	250 ml	P/O	Lab/Sample ID (Lab Use Only)									
S	8/14/03	1245	X		SED 6 03634 Soil	6				4	1	1	452971						
S	8/14/03	1320	X		SED 5 03633	6				4	1	1	452972						
S	8/14/03	1400	X		SED 4 03632	6				4	1	1	452973						
S	8/18/03	1430	X		SED 3 03631	6				4	1	1	452974						
S	8/18/03	1530	X		SED 2 03630	6				4	1	1	452975						
S	8/19/03	1000	X		SED 1 18N03629	6				4	1	1	452976						
<div style="position: relative;"> <div style="position: absolute; top: 0; right: 0; transform: rotate(45deg);"> up 8/19 </div> </div>																			
Relinquished by: (Signature) <u>Brian Janikowski</u>				Date <u>8/19/03</u>	Time <u>845</u>	Received by: (Signature) <u>Walter Janikowski</u>				Date <u>8-19-03</u>	Time <u>0845</u>	Remarks <u>Sediment samples</u> <u>Provide NJ DEP EDD</u> Client's delivery of samples constitutes acceptance of Severn Trent Laboratories terms and conditions contained in the Price Schedule.							
Relinquished by: (Signature) <u>Walter Janikowski</u>				Date <u>8-19-03</u>	Time <u>1115</u>	Received by: (Signature) <u>Rachel Janikowski</u>				Date <u>8/19/03</u>	Time <u>1115</u>								
Relinquished by: (Signature) <u>Rachel Janikowski</u>				Date <u>8-19</u>	Time <u>1315</u>	Received by: (Signature) <u>Janikowski</u>				Date <u>8-19-03</u>	Time <u>1315</u>								
<div style="display: flex; justify-content: space-between; font-size: small;"> <div> ¹Matrix WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil ²Container VOA - 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth P/O - Plastic or other </div> <div> STL cannot accept verbal changes. Please Fax written changes to (802) 655-1248 </div> </div>																			

STL-8234 (0700)

REC'D FOR AMERICAN AQUATIC Valley 08/21/03 1830 HOS

CHAIN OF CUSTODY RECORD

Report to: Company: <u>Louis Berger Group</u> Address: <u>30 Ureeland Rd. Bldg A</u> <u>Florham Park, NJ 07932</u> Contact: <u>Tom Tancico</u> Phone: <u>973-678-1960 x 608</u> Fax: <u>973-676-3564</u> Contract/ Quote: _____		Invoice to: Company: <u>Louis Berger Group</u> Address: <u>30 Ureeland Rd Bldg A</u> <u>Florham Park, NJ 07932</u> Contact: <u>Tom Tancico</u> Phone: <u>973-678-1960 x 608</u> Fax: <u>973-676-3564</u>		ANALYSIS REQUESTED		Lab Use Only Due Date: Temp. of coolers when received (C°): <table><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr></table> Custody Seal N / Y Intact N / Y Screened For Radioactivity <input type="checkbox"/>										1	2	3	4	5			
1	2	3	4	5																			
Sampler's Name <u>Brian Tancavskas</u>		Sampler's Signature <u>Brian Tancavskas</u>		<div>TOXICITY</div>																			
Proj. No. <u>SG-1982</u>		Project Name <u>Matteo Iron & Metal</u>																No/Type of Containers? <u>32 / P 11 liter</u>					
Matrix ¹	Date	Time	C o m p	G r a b	Identifying Marks of Sample(s)	VOA	A/G 1 Lt.	250 ml	P/O	Lab/Sample ID (Lab Use Only)													
S	8/20	1300		X	SED 1					Y	15TN 03629												
S	8/20	1230		X	SED 2					Y	03630												
S	8/20	1210		X	SED 3					Y	03631												
S	8/20	1145		X	SED 4					Y	03632												
S	8/20	1120		X	SED 5					Y	03633 03633												
S	8/20	1050		X	SED 6					Y	03634 03635												
S	8/20	1200		X	SED 8					Y	03636												
S	8/20	1220		X	SED 9					Y	03637												
Relinquished by: (Signature) <u>[Signature]</u>		Date 8/21/02	Time 8:30	Received by: (Signature) <u>[Signature]</u>		Date 8-21-02	Time 0840	Remarks provide US DEP EDD															
Relinquished by: (Signature) <u>[Signature]</u>		Date 8-21-02	Time 1200	Received by: (Signature) <u>[Signature]</u>		Date 8-21-03	Time 12:00	Client's delivery of samples constitutes acceptance of Severn Trent Laboratories terms and conditions contained in the Price Schedule.															
Relinquished by: (Signature) <u>[Signature]</u>		Date 8-21-03	Time 1330	Received by: (Signature) <u>[Signature]</u>		Date	Time	STL cannot accept verbal changes. Please Fax written changes to (802) 655-1248															
1 Matrix: WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil																							
2 Container: VOA - 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth P/O - Plastic or other																							

CHAIN OF CUSTODY

Job #: 3RS

Client: AAT, Inc.

Client Contact: CHRIS NALLY

Address:

Phone #:

Sample	Return to client	NO
<u>Disposal:</u>	Lab disposal	

[illegible]

Samples were:

i. Collected by AAT personnel
Client personnel

[X] 2. Transported on ice?

3. Received within holding time?

4. Sample matrix is:

Liquid ☐ Sediment ☒
Soil ☐ Other ☐

[illegible]

Appendix D

Fish field data sheets

Station	1	Replicate	1	Date	8/25	Sample Time	17:20	Time of Low Tide	19:20
---------	---	-----------	---	------	------	-------------	-------	------------------	-------

[illegible]

Length is in millimeters

Station	2	Replicate	1	Date	8/25	Sample Time	9:30	Time of Low Tide	7:19
---------	---	-----------	---	------	------	-------------	------	------------------	------

Species	<i>Fundulus heteroclitus</i>		<i>Morone americana</i>		<i>Lepomis gibbosus</i>													
Total Caught	3		1		1													
Tissue Sample	no		no		no													
	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count
30			60		30													
31	1		61		31													
32			62		32													
33	1		63		33													
34			64	1	34													
35			65		35													
36			66		36	1												
37			67		37													
38			68		38													
39			69		39													
40																		
41																		
42																		
43																		
44																		
45																		
46																		
47																		
48																		
49																		
50																		
51																		
52																		
53																		
54																		
55																		
56																		
57																		
58																		
59																		
60																		
61	1																	
62																		
63																		
64																		
65																		
66																		
67																		
68																		
69																		

Station	2	Replicate	2	Date	8/25	Sample Time	9:35	Time of Low Tide	7:19
---------	---	-----------	---	------	------	-------------	------	------------------	------

[illegible]

Station	2	Replicate	3	Date	8/25	Sample Time	9:40	Time of Low Tide	7:19
---------	---	-----------	---	------	------	-------------	------	------------------	------

[illegible]

Length is in millimeters

Station	3	Replicate	1	Date	8/28	Sample Time	8:55	Time of Low Tide	9:39
---------	---	-----------	---	------	------	-------------	------	------------------	------

[illegible]

Length is in millimeters

Station	3	Replicate	2	Date	8/28	Sample Time	8:59	Time of Low Tide	9:39
---------	---	-----------	---	------	------	-------------	------	------------------	------

[illegible]

Length is in millimeters

Station	3	Replicate	3	Date	8/28	Sample Time	9:05	Time of Low Tide	9:39
---------	---	-----------	---	------	------	-------------	------	------------------	------

[illegible]

Length is in millimeters

Station 4 Replicate 1 Date 8/28 Sample Time 10:50 Time of Low Tide 9:39

Species	<i>Fundulus diaphanus</i>		<i>Fundulus heteroclitus</i>		<i>Lepomis gibbosus</i>		<i>Alosa pseudoharengus</i>											
Total Caught	79		253		2		1											
Tissue Sample	yes		no		yes		no											
	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count
	30		40	1	90		40											
	31		41		91		41											
	32	2	42	1	92		42											
	33		43	1	93	1	43											
	34		44		94		44											
	35	2	45		95		45											
	36		46		96		46											
	37		47	1	97		47	1										
	38	1	48		98		48											
	39		49		99	1	49											
	40		50															
	41	1	51	2														
	42	2	52	1														
	43	2	53	1														
	44	1	54	1														
	45		55															
	46		56	1														
	47		57	1														
	48	1	58															
	49		59															
	50		60	2														
	51		61															
	52	1	62															
	53		63	1														
	54	1	64	1														
	55		65															
	56	1	66	3														
	57		67	1														
	58		68	1														
	59		69															
	60		70	1														
	61	1	71															
	62		72															
	63		73															
	64	1	74															
	65		75	1														
	66	1	76	2														
	67	1	77	1														
	68	1	78															
	69		79	1														
	70	3	80	1														
	71		81															
	72	1	82															
	73		83	2														
	74		84	2														
	75	1	85															
	76		86															
	77	1	87															
	78	1	88															
	79		89															
	80																	
	81																	
	82	2																
	83																	
	84																	
	85	1																
	86	1																
	87																	
	88	1																
	89	1																
	90	2																
	91																	
	92																	
	93																	
	94																	
	95	1																
	96																	
	97																	
	98																	
	99																	

Length is in millimeters

Station	4	Replicate	2	Date	8/28	Sample Time	10:55	Time of Low Tide	9:39
---------	---	-----------	---	------	------	-------------	-------	------------------	------

Species	<i>Fundulus diaphanus</i>		<i>Fundulus heteroclitus</i>		<i>Lepomis gibbosus</i>		<i>Alosa pseudoharengus</i>											
Total Caught	78		112		1		1											
Tissue Sample	yes		no		yes		no											
	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count
	30	1	30		30		50											
	31		31		31		51											
	32		32	1	32		52											
	33		33		33		53											
	34		34		34		54											
	35		35		35		55											
	36		36		36		56	1										
	37		37		37		57											
	38		38		38		58											
	39		39		39	1	59											
	40	1	40															
	41		41															
	42		42															
	43		43															
	44		44															
	45	2	45															
	46	1	46															
	47		47															
	48		48															
	49		49	3														
	50		50	1														
	51		51															
	52		52	3														
	53		53	1														
	54		54	2														
	55		55	4														
	56	1	56	2														
	57		57	2														
	58	1	58	2														
	59		59	2														
	60	2	60	2														
	61	2	61	3														
	62	3	62															
	63		63															
	64	2	64	1														
	65	2	65	1														
	66	2	66															
	67	1	67	1														
	68	2	68	1														
	69	1	69	2														
	70	3	70															
	71		71															
	72	5	72															
	73	1	73															
	74	1	74															
	75	1	75	2														
	76		76															
	77	1	77															
	78	1	78															
	79		79															
	80	1																
	81																	
	82	1																
	83	1																
	84																	
	85																	
	86																	
	87																	
	88																	
	89	1																
	90																	
	91																	
	92																	
	93																	
	94	1																
	95																	
	96																	
	97																	
	98																	
	99																	

Length is in millimeters

Station 4 Replicate 3 Date 8/28 Sample Time 11:00 Time of Low Tide 9:39

Species	<i>Fundulus diaphanus</i>		<i>Fundulus heteroclitus</i>		<i>Lepomis gibbosus</i>													
Total Caught	149		343		4													
Tissue Sample	yes		no		yes													
	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count
	30		40		30													
	31		41	1	31													
	32		42		32													
	33		43		33													
	34		44		34													
	35		45	2	35													
	36		46		36	1												
	37	1	47		37													
	38		48		38													
	39	1	49	3	39													
	40	2	50		40													
	41		51		41													
	42		52		42													
	43	1	53		43	1												
	44		54	1	44													
	45	2	55	1	45													
	46	2	56		46													
	47		57	1	47													
	48		58		48													
	49		59	1	49													
	50		60															
	51		61															
	52		62	1														
	53		63	1														
	54		64	3														
	55		65	1														
	56	1	66	1														
	57	1	67															
	58	1	68	1														
	59	1	69															
	60	1	70	1														
	61		71															
	62		72	2														
	63	1	73	2														
	64		74	1														
	65	1	75	2														
	66		76															
	67	2	77	1														
	68		78															
	69		79	1														
	70	1	80	1														
	71	2	81															
	72		82															
	73	2	83															
	74		84															
	75	1	85	1														
	76		86															
	77		87															
	78		88															
	79		89															
	80				90													
	81	1			91													
	82				92													
	83				93													
	84				94													
	85	1			95													
	86	1			96	1												
	87				97													
	88				98													
	89				99													
					100													
					101													
					102													
					103	1												
					104													
					105													
					106													
					107													
					108													
					109													

Length is in millimeters

Station	5	Replicate	1	Date	8/29	Sample Time	9:20	Time of Low Tide	10:20
---------	---	-----------	---	------	------	-------------	------	------------------	-------

Species	<i>Fundulus diaphanus</i>		<i>Fundulus heteroclitus</i>															
Total Caught	26		124															
Tissue Sample	yes		no															
	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count
	20		30															
	21		31															
	22		32	1														
	23		33															
	24		34															
	25		35	1														
	26		36	2														
	27		37	3														
	28	1	38	3														
	29		39	3														
	30	1	40															
	31	1	41	2														
	32	1	42	6														
	33	2	43	1														
	34	2	44	2														
	35	3	45	3														
	36	1	46	1														
	37	3	47	3														
	38	1	48	2														
	39	2	49	1														
	40	2	50															
	41	1	51	1														
	42	2	52	1														
	43		53	1														
	44		54															
	45		55															
	46	1	56															
	47	1	57	2														
	48		58															
	49		59															
	50		60															
	51		61															
	52		62	1														
	53		63															
	54		64															
	55		65															
	56		66															
	57		67															
	58		68															
	59		69															
	60	1																
	61																	
	62																	
	63																	
	64																	
	65																	
	66																	
	67																	
	68																	
	69																	

Length is in millimeters

Station	5	Replicate	3	Date	8/29	Sample Time	9:30	Time of Low Tide	10:20
---------	---	-----------	---	------	------	-------------	------	------------------	-------

[illegible]

Length is in millimeters

Station 6 Replicate 1 Date 8/26 Sample Time 8:15 Time of Low Tide 8:54

Species	<i>Fundulus diaphanus</i>		<i>Fundulus heteroclitus</i>															
Total Caught	24		12															
Tissue Sample	no		no															
	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count
	30		30															
	31		31															
	32	1	32															
	33	1	33															
	34	3	34															
	35	2	35															
	36	2	36	1														
	37	2	37															
	38		38	2														
	39	1	39	1														
	40	1	40															
	41		41	1														
	42		42															
	43	2	43	1														
	44	4	44	1														
	45		45															
	46		46	1														
	47		47															
	48	2	48															
	49	1	49															
	50		50															
	51		51															
	52		52															
	53		53	1														
	54		54															
	55		55															
	56		56	1														
	57	1	57															
	58		58															
	59		59															
	60		60															
	61		61															
	62		62															
	63		63															
	64		64															
	65		65															
	66		66															
	67		67															
	68		68															
	69		69															
	70		70															
	71		71															
	72		72															
	73		73															
	74		74															
	75	1	75															
	76		76	1														
	77		77															
	78		78															
	79		79															
			80															
			81															
			82	1														
			83															
			84															
			85															
			86															
			87															
			88															
			89															

Length is in millimeters

[illegible]

Length is in millimeters

Station

6

Replicate

3

Date _____

8/26

Sample Time

8:25

Time of Low Tide

8:54

Length is in millimeters

Station	7	Replicate	1	Date	8/27	Sample Time	8:45	Time of Low Tide	8:54
---------	---	-----------	---	------	------	-------------	------	------------------	------

Species	<i>Fundulus diaphanus</i>		<i>Fundulus heteroclitus</i>		<i>Lepomis gibbosus</i>		<i>Etheostoma olmstedii</i>											
Total Caught	9		7		1		1											
Tissue Sample	no		no		no		no											
	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count
	30		50		90		60											
	31		51		91	1	61											
	32		52		92		62											
	33		53		93		63											
	34		54	1	94		64											
	35		55		95		65											
	36		56	1	96		66											
	37		57	1	97		67											
	38	1	58		98		68	1										
	39		59	1	99		69											
	40	1	60	1														
	41		61	1														
	42		62															
	43		63	1														
	44		64															
	45		65															
	46		66															
	47		67															
	48	1	68															
	49		69															
	50																	
	51	1																
	52																	
	53																	
	54																	
	55	2																
	56																	
	57																	
	58																	
	59																	
	60																	
	61																	
	62																	
	63																	
	64																	
	65																	
	66																	
	67																	
	68																	
	69																	
	70																	
	71																	
	72																	
	73																	
	74	1																
	75																	
	76																	
	77																	
	78																	
	79																	
	80	1																
	81																	
	82																	
	83																	
	84																	
	85																	
	86																	
	87																	
	88																	
	89																	
	90																	
	91																	
	92																	
	93																	
	94																	
	95																	
	96																	
	97																	
	98	1																
	99																	

Length is in millimeters

[illegible]

Length is in millimeters

Station 7 Replicate 3 Date 8/26 Sample Time 8:55 Time of Low Tide 8:54

Species	<i>Fundulus diaphanus</i>		<i>Fundulus heteroclitus</i>		<i>Morone americana</i>		<i>Etheostoma olmstedii</i>		<i>Alosa pseudoharengus</i>									
Total Caught	7		4		1		1		3									
Tissue Sample	no		no		no		no		no									
	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count
50			60	1	50		60		50									
51			61		51	1	61		51	1								
52			62		52		62		52									
53			63		53		63		53									
54	1		64		54		64		54									
55			65		55		65		55									
56			66		56		66	1	56									
57			67		57		67		57	1								
58			68		58		68		58	1								
59			69		59		69		59									
60			70															
61	1		71															
62			72															
63			73	1														
64			74															
65	1		75															
66			76															
67			77	1														
68	1		78	1														
69			79															
70																		
71																		
72																		
73																		
74																		
75																		
76																		
77	1																	
78																		
79																		
80																		
81																		
82																		
83																		
84																		
85																		
86																		
87																		
88	1																	
89																		
90																		
91																		
92																		
93	1																	
94																		
95																		
96																		
97																		
98																		
99																		
														</				

Length is in millimeters

Station 8 Replicate 1 Date 8/25 Sample Time 7:30 Time of Low Tide 7:19

Species	<i>Fundulus diaphanus</i>		<i>Alosa pseudoharengus</i>		<i>Lepomis gibbosus</i>		<i>Etheostoma olmstedii</i>		<i>Morone americana</i>		<i>Anguilla rostrata</i>		<i>Hybognathus regius</i>		<i>Trinectes maculatus</i>		<i>Anchoa spp.</i>		
Total Caught	134		27		2		8		13		2		1		2		1		
Tissue Sample	yes		no		no		no		no		no		no		no		no		
	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	
20			30		90		40		40		60		60	1	50		30		
21			31		91		41	1	41		61		61		51		31		
22			32		92	1	42		42	1	62		62		52		32		
23			33		93		43		43	1	63		63		53	1	33		
24			34		94	1	44	1	44	2	64		64		54		34		
25			35		95		45		45		65		65		55		35		
26			36		96		46		46	1	66		66		56		36	1	
27			37	5	97		47		47	2	67		67		57		37		
28	1		38	2	98		48	1	48	1	68	1	68		58		38		
29	1		39	5	99		49	1	49		69		69		59	1	39		
30			40	4			50	2	50	1	70								
31			41	3			51		51	1	71								
32			42	3			52		52		72								
33	2		43	2			53	1	53	2	73								
34			44	2			54		54		74								
35			45				55		55		75								
36	1		46				56		56		76								
37	1		47				57		57		77								
38	1		48	1			58		58	1	78								
39			49				59		59		79								
40							60				80								
41	2						61				81								
42	1						62	1			82								
43							63				83								
44							64				84								
45	2						65				85								
46	1						66				86								
47	2						67				87	1							
48							68				88								
49	1						69				89								
50																			
51																			
52																			
53																			
54	1																		
55																			
56																			
57																			
58																			
59																			
60	1																		
61																			
62																			
63	1																		
64																			
65																			
66																			
67																			
68	2																		
69																			
70																			
71	1																		
72																			
73																			
74	1																		
75																			
76																			
77	1																		
78																			
79	1																		

Length is in millimeters

Station 8 Replicate 2 Date 8/25 Sample Time 7:45 Time of Low Tide 7:19

Species	<i>Fundulus diaphanus</i>		<i>Fundulus heteroclitus</i>		<i>Alosa pseudoharengus</i>		<i>Etheostoma olmstedi</i>		<i>Morone americana</i>		<i>Anguilla rostrata</i>		<i>Hybognathus regius</i>		<i>Trinectes maculatus</i>		<i>Anchoa spp.</i>		<i>Morone saxatilis</i>	
Total Caught	203		1		8		1		27		1		1		1		1		2	
Tissue Sample	yes		no		no		no		no		no		no		no		no		no	
	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count
20			60		30		50		30		70		40		20		30		70	
21			61		31		51		31		71	1	41		21		31		71	
22			62		32		52		32		72		42		22		32		72	
23			63		33		53		33		73		43		23		33		73	
24			64	1	34		54		34		74		44		24	1	34		74	
25			65		35		55		35		75		45	1	25		35		75	1
26			66		36		56		36		76		46		26		36		76	1
27			67		37	2	57		37		77		47		27		37		77	
28			68		38		58		38	1	78		48		28		38	1	78	
29	2		69		39		59	1	39		79		49		29		39		79	
30	2				40	2			40	1										
31	1				41				41	1										
32	1				42				42	3										
33	1				43	2			43	3										
34	2				44	1			44											
35	1				45				45	1										
36	4				46	1			46	3										
37					47				47	4										
38	2				48				48	1										
39	1				49				49	1										
40									50	2										
41									51	2										
42									52	2										
43	1								53											
44	1								54	1										
45									55											
46	1								56											
47									57											
48	1								58											
49									59	1										
50																				
51	1																			
52																				
53																				
54																				
55																				
56																				
57																				
58																				
59																				
60																				
61																				
62																				
63	1																			
64																				
65																				
66																				
67																				
68	1																			
69																				
70																				
71	1																			
72																				
73																				
74																				
75																				
76																				
77																				
78																				
79																				

Length is in millimeters

Station 9 Replicate 1 Date 8/26 Sample Time 8:35 Time of Low Tide 8:54

Species	<i>Fundulus diaphanus</i>		<i>Alosa pseudoharengus</i>		<i>Lepomis gibbosus</i>		<i>Fundulus heteroclitus</i>		<i>Morone americana</i>		<i>Hybognathus regius</i>							
Total Caught	93		4		2		1		12		21							
Tissue Sample	yes		no		no		no		no		no							
	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count
20			40		40		70		30		40							
21			41		41		71		31		41							
22			42		42	1	72		32		42							
23			43	1	43		73		33		43							
24			44		44		74		34		44	3						
25			45	1	45		75	1	35	1	45	3						
26	3		46		46		76		36		46							
27			47		47		77		37		47	2						
28	2		48		48		78		38	1	48	3						
29	6		49		49		79		39		49	2						
30			50	1	50				40	1	50	2						
31	4		51		51				41		51							
32	2		52		52				42		52	3						
33	8		53		53				43	3	53	2						
34	4		54		54				44		54							
35	2		55		55				45		55	1						
36	4		56	1	56				46	2	56							
37	1		57		57				47	1	57							
38	6		58		58				48	2	58							
39	5		59		59				49		59							
40	3				60				50	1								
41	2				61				51									
42	1				62				52									
43	4				63				53									
44	2				64				54									
45	3				65				55									
46	3				66				56									
47	4				67				57									
48	2				68				58									
49	1				69				59									
50	1				70													
51					71													
52					72													
53					73													
54					74													
55					75													
56					76													
57					77													
58					78													
59					79													
60					80													
61					81													
62					82													
63	1				83													
64					84													
65					85													
66					86													
67	1				87													
68	2				88													
69	3				89													
70	2				90													
71	2				91													
72	1				92	1												
73	2				93													
74	2				94													
75					95													
76	2				96													
77	1				97													
78					98													
79					99													
80																		
81																		
82																		
83																		
84																		
85																		
86																		
87																		
88	1																	
89																		

Length is in millimeters

Station 9 Replicate 2 Date 8/26 Sample Time 8:45 Time of Low Tide 8:54

Species	<i>Fundulus diaphanus</i>		<i>Fundulus heteroclitus</i>		<i>Lepomis gibbosus</i>		<i>Etheostoma olmstedii</i>		<i>Morone americana</i>		<i>Anguilla rostrata</i>		<i>Hybognathus regius</i>		<i>Anchoa spp.</i>			
Total Caught	141		5		2		1		5		1		3		1			
Tissue Sample	yes		no		no		no		no		no		no		no			
	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count
	20		40		20		50		40		250		40		40			
	21		41	1	21	1	51		41	1	251		41		41			
	22		42		22		52	1	42		252		42	1	42	1		
	23		43		23		53		43		253	1	43		43			
	24		44		24		54		44		254		44		44			
	25		45		25		55		45		255		45		45			
	26		46		26		56		46		256		46		46			
	27	1	47		27		57		47	1	257		47	1	47			
	28		48		28		58		48	1	258		48		48			
	29		49	1	29		59		49		259		49		49			
	30		50						50				50					
	31		51						51				51					
	32		52						52				52					
	33		53						53				53	1				
	34	3	54						54	2			54					
	35	2	55						55				55					
	36	6	56	1					56				56					
	37	2	57						57				57					
	38		58						58				58					
	39	2	59						59				59					
	40	4	60	1														
	41		61															
	42	1	62															
	43	1	63															
	44	1	64															
	45	3	65															
	46		66															
	47		67	1														
	48		68															
	49		69															
	50																	
	51	1																
	52																	
	53																	
	54																	
	55																	
	56																	
	57																	
	58																	
	59																	
	60																	
	61																	
	62																	
	63																	
	64	1																
	65																	
	66																	
	67																	
	68																	
	69																	
	70																	
	71																	
	72																	
	73																	
	74																	
	75																	
	76																	
	77																	
	78																	
	79																	
	80						90											
	81						91											
	82						92											
	83	1					93											
	84						94											
	85						95											
	86						96											
	87						97	1										
	88						98											
	89						99											

Length is in millimeters

Station 9 Replicate 3 Date 8/26 Sample Time 9:10 Time of Low Tide 8:54

Species	<i>Fundulus diaphanus</i>		<i>Fundulus heteroclitus</i>		<i>Morone americana</i>		<i>Lepomis gibbosus</i>		<i>Anguilla rostrata</i>		<i>Hybognathus regius</i>							
Total Caught	150		9		2		1		1		14							
Tissue Sample	yes		no		no		no		no		no							
	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count
	20		40		50	1	30		190		30							
	21		41		51	1	31	1	191		31							
	22		42	1	52		32		192		32							
	23		43	1	53		33		193		33							
	24		44	1	54		34		194		34							
	25		45		55		35		195		35							
	26		46		56		36		196		36	1						
	27		47		57		37		197		37							
	28		48		58		38		198		38	1						
	29	2	49		59		39		199	1	39	1						
	30	1	50								40							
	31		51								41							
	32		52								42							
	33	2	53								43							
	34	1	54								44							
	35	3	55								45	1						
	36	1	56								46							
	37	2	57								47	1						
	38	2	58								48	2						
	39	1	59	1							49	3						
	40	4	60								50	1						
	41		61								51	1						
	42	1	62								52							
	43		63								53							
	44		64	2							54	2						
	45	2	65								55							
	46		66								56							
	47		67								57							
	48		68								58							
	49	1	69								59							
	50	2	70	1														
	51		71															
	52		72															
	53		73															
	54		74															
	55		75															
	56		76															
	57		77															
	58		78	1														
	59		79															
	60		80															
	61		81															
	62		82															
	63	2	83															
	64		84	1														
	65	1	85															
	66		86															
	67		87															
	68	1	88															
	69		89															
	70																	
	71	2																
	72																	
	73																	
	74																	
	75																	
	76																	
	77	1																
	78																	
	79																	
	80																	
	81																	
	82	1																
	83																	
	84																	
	85																	
	86																	
	87																	
	88																	
	89																	

Length is in millimeters

Station 10 Replicate 1 Date 8/26 Sample Time 7:45 Time of Low Tide 8:54

Species	<i>Fundulus diaphanus</i>		<i>Alosa pseudohareng</i>		<i>Hybognathus regius</i>		<i>Morone saxatilis</i>		<i>Morone americana</i>		<i>Etheostoma olmstedi</i>							
Total Caught	40		4		19		1		3		5							
Tissue Sample	yes		no		no		no		no		no							
	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count
	20		40		40		70	1	40		40							
	21		41		41		71		41		41							
	22		42		42		72		42		42							
	23		43		43	1	73		43		43							
	24		44		44		74		44		44	2						
	25		45	1	45	1	75		45		45							
	26	1	46		46	1	76		46	1	46							
	27	1	47		47	1	77		47		47							
	28		48		48		78		48		48							
	29	1	49		49		79		49	1	49	1						
	30		50		50				50		50	1						
	31	2	51		51	1			51		51							
	32		52		52	2			52	1	52							
	33	2	53		53	3			53		53							
	34	3	54		54				54		54							
	35	2	55	2	55	1			55		55	1						
	36		56		56	2			56		56							
	37	1	57		57	1			57		57							
	38	1	58	1	58	1			58		58							
	39	1	59		59				59		59							
	40	3			60	1												
	41	1			61													
	42				62	1												
	43	2			63	1												
	44	3			64													
	45	2			65													
	46				66													
	47	1			67													
	48	1			68													
	49				69													
	50				70													
	51				71													
	52				72													
	53				73	1												
	54				74													
	55				75													
	56				76													
	57	1			77													
	58				78													
	59				79													
	60																	
	61																	
	62																	
	63																	
	64																	
	65																	
	66																	
	67																	
	68	1																
	69	1																
	70																	
	71																	
	72																	
	73																	
	74																	
	75	1																
	76	1																
	77																	
	78	1																
	79	1																
	80																	
	81	2																
	82	1																
	83																	
	84																	
	85																	
	86	1																
	87	1																
	88																	
	89																	

Length is in millimeters

Station 10 Replicate 2 Date 8/26 Sample Time 8:45 Time of Low Tide 8:54

Species	<i>Fundulus diaphanus</i>		<i>Fundulus heteroclitus</i>		<i>Morone americana</i>		<i>Hybognathus regius</i>		<i>Alosa pseudohareng</i>		<i>Menidia menidia</i>							
Total Caught	9		1		1		5		9		1							
Tissue Sample	yes		no		no		no		no		no							
	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count
40			70		50		30	1	40		30							
41			71		51	1	31		41		31							
42	1		72		52		32		42		32							
43			73		53		33		43		33							
44			74		54		34		44	1	34							
45			75		55		35		45		35							
46			76		56		36		46	3	36	1						
47			77		57		37		47	2	37							
48			78		58		38		48	1	38							
49			79	1	59		39		49		39							
50							40		50									
51							41		51									
52	1						42		52									
53							43		53	1								
54							44		54	1								
55							45		55									
56							46		56									
57							47		57									
58							48		58									
59							49		59									
60							50											
61							51											
62							52	1										
63							53	1										
64							54	1										
65	1						55											
66							56											
67							57	1										
68	1						58											
69							59											
70																		
71	1																	
72																		
73																		
74																		
75																		
76	1																	
77																		
78																		
79	1																	
80																		
81																		
82																		
83																		
84	1																	
85																		
86																		
87																		
88																		
89																		
90																		
91																		
92																		
93																		
94	1																	
95																		
96																		
97																		
98																		
99																		

Length is in millimeters

Station	10	Replicate	3	Date	8/26	Sample Time	7:55	Time of Low Tide	8:54
---------	----	-----------	---	------	------	-------------	------	------------------	------

Species	<i>Fundulus diaphanus</i>		<i>Fundulus heteroclitus</i>		<i>Morone americana</i>		<i>Lepomis gibbosus</i>		<i>Morone saxatilis</i>		<i>Hybognathus regius</i>							
Total Caught	12		3		10		1		1		18							
Tissue Sample	yes		no		no		no		no		no							
	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count	length	count
	30		50		40		30		70		30							
	31		51		41		31		71		31							
	32		52		42		32	1	72		32	1						
	33	1	53		43		33		73		33							
	34		54		44		34		74		34							
	35		55		45	1	35		75	1	35							
	36		56		46		36		76		36							
	37		57		47	1	37		77		37							
	38	1	58		48		38		78		38							
	39		59	1	49	1	39		79		39							
	40		60		50	1					40							
	41		61		51						41							
	42		62		52	1					42							
	43		63		53	1					43							
	44		64		54	1					44	1						
	45		65	1	55						45							
	46		66		56						46	1						
	47		67		57						47							
	48		68		58	1					48	3						
	49		69		59						49	1						
	50		70		60						50							
	51		71		61	1					51	2						
	52		72	1	62	1					52	1						
	53		73		63						53	1						
	54		74		64						54	1						
	55		75		65						55	2						
	56		76		66						56	2						
	57		77		67						57							
	58		78		68						58							
	59		79		69						59							
	60										60	1						
	61										61							
	62										62							
	63										63							
	64										64	1						
	65	1									65							
	66										66							
	67	2									67							
	68										68							
	69										69							
	70																	
	71																	
	72																	
	73																	
	74																	
	75	1																
	76																	
	77																	
	78	1																
	79																	
	80	1																
	81	1																
	82																	
	83																	
	84																	
	85																	
	86	1																
	87																	
	88																	
	89	1																
	90																	
	91	1																
	92																	
	93																	
	94																	
	95																	
	96																	
	97																	
	98																	
	99																	

Length is in millimeters

Appendix E

Statistical summary of fish catch in the study area

Statistical summary of fish catch in the study area

Station	1			2			3			4			5			6			7			8			9			10			On-site Stations	Reference Stations	Total Individuals				
Replicate	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	(3,4,5,6)	(1,2,7,8,9,10)	All Stations	Species			
Fundulus diaphanus	4	7	3			3	4	2	9	79	78	149	26	34	7	24	4	22	9	6	7	134	203	33	93	141	150	40	9	12	438	854	1292	Fundulus diaphanus			
Fundulus heteroclitus	5	2	1	3	2	1	3	2	7	253	112	343	124	82	18	12	5	9	7	5	4		1	1	1	5	9		1	3	970	51	1021	Fundulus heteroclitus			
Etheostoma olmstedt		1																	1	1	1	8	1	1		1		5			20	20	Etheostoma olmstedt				
Hybognathus regius	1					1																1	1		21	3	14	19	5	18		84	84	Hybognathus regius			
Alosa pseudoharengus										1	1										3	27	8	4	4			4	9		2	59	61	Alosa pseudoharengus			
Lepomis gibbosus				1						2	1	4			1				1			2			2	2	1			1	8	10	18	Lepomis gibbosus			
Anguilla rostrata																						2	1			1	1					5	5	Anguilla rostrata			
Anchoa spp.																						1	1			1						3	3	Anchoa spp.			
Menidia menidia																													1			1	1	Menidia menidia			
Morone americana				1																	1	13	27	4	12	5	2	3	1	10		79	79	Morone americana			
Morone saxatilis																						2	2					1		1		6	6	Morone saxatilis			
Trinectes maculatus																				1			2	1								4	4	Trinectes maculatus			
Total Abundance	10	10	4	5	2	5	7	4	16	335	192	496	150	116	26	36	9	31	18	13	16	190	246	45	133	159	177	72	26	45	1418	1176	2594	Total Abundance			
Station Mean	8.00			4.00			9.00			341.00			97.33			25.33			15.67			160.33			156.33			47.67									
Variance	12.00			3.00			39.00			23131.00			4105.33			206.33			6.33			10760.33			489.33			534.33									
Total Species	3	3	2	3	1	3	2	2	2	4	4	3	2	2	3	2	2	2	4	4	5	9	10	6	6	8	6	6	6	6	6						
Station Mean	2.7			2.3			2.0			3.7			2.3			2.0			4.3			8.3			6.7			6.0			4	12	12	MeanTaxa/Species			
Variance	0.33			1.33			0.00			0.33			0.33			0.00			0.33			4.33			1.33			0.00									
Diversity (H')	0.410	0.348	0.244	0.413	0.000	0.413	0.297	0.301	0.298	0.261	0.319	0.285	0.200	0.263	0.318	0.276	0.298	0.262	0.450	0.486	0.594	0.451	0.298	0.419	0.419	0.239	0.261	0.528	0.620	0.609							
Station Mean	0.334			0.275			0.298			0.288			0.260			0.279			0.510			0.390			0.306			0.586			0.287	0.473	0.492	Mean Diverstiy			

Appendix F

Benthic macroinvertebrate data sheets

Statistical summary of benthic macroinvertebrates collected in the study area

Species/Taxa Collected		Station	1			2			3			4			5			6			7			8			9			10			On-site stations (3,4,5,6)	Reference stations (1,2,7,8,9,10)	Total Individuals All Stations	
		Replicate	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3							
OLIGOCHAETA																																		Species/Taxa Oligochaeta A Oligochaeta B		
	Oligochaeta A	2		6	112	24	23	149	12	11	1	13	1	88	6	32	8	27	33	14	21	3	6	8	5	16	18	14	3	9	6	381	290		671	
	Oligochaeta B													8	5	6	1		2	1	3		1	2	1						22	8	30			
INSECTA																																				
	Odonata																																			
	Gomphidae (naiad)	1																														1	1	Gomphidae		
	Diptera																																			
	Chironomidae (larva/pupa)	17	14	10	49	17	4	24	5	9	6	5	2	22	17	7	24	19	42	7	7	1	5	7	7	2			2	9	8	182	166	348	Chironomidae	
CRUSTACEA																																				
	Isopoda																																			
	Anthuridae				1																									3	1	5	5	Anthuridae		
	Amphipoda																																			
	Gammaridae		6	1																			1									8	8	Gammaridae		
BIVALVIA																																				
	Veneroida																																			
	Corbiculidae																																			
	Corbicula fluminea	20	21	9	9	11	1	9	2	1	1			9	1	1			2		1		1	3	1	1	1	2	1	5		26	87	113	Corbicula fluminea	
	Paleoheterodonta																																			
	Unionidae	1	1	2	1		1																									6	6	Unionidae		
HIRUDINEA		2				1	2	1	2					1																		4	5	9	Hirudinea	
	Total Abundance	43	42	28	172	53	31	183	21	21	8	18	3	128	29	46	33	46	79	22	32	4	14	20	14	19	19	16	6	26	15	615	576	1191	Total Abundance	
	Station Mean	37.67			85.33			75.00			9.67			67.67				52.67		19.33			16.00			18.00			15.67							
	Variance	70.33			5754.33			8748.00			58.33			2802.33				62.33		201.33			12.00			3.00			100.33							
	Total Taxa/species	6	4	5	5	5	6	5	4	3	3	2	2	5	4	4	3	2	4	3	4	2	5	4	4	3	2	2	3	4	3	6	10	10	MeanTaxa/Species	
	Station Mean	5.0			5.3			4.0			2.3			4.3				3.0		3.0			4.3			2.3			3.3							
	Variance	1.00			0.33			1.00			0.33			0.33				1.00		1.00			0.33			0.33			0.33							
	Diversity (H')	0.51	0.47	0.60	0.37	0.49	0.38	0.27	0.48	0.37	0.32	0.26	0.28	0.42	0.46	0.39	0.30	0.29	0.39	0.34	0.41	0.24	0.56	0.54	0.47	0.23	0.09	0.16	0.44	0.56	0.38	0.4207172	0.521411046	0.45652758	Mean Diversity	
	Station Mean	0.53			0.41			0.37			0.28			0.42				0.33		0.33			0.53			0.16			0.46							

Matteo Iron and Metal
Benthic Macroinvertebrate
Inventory Data Sheet

Station # -	Replicate # -	Substrate Type -	
ID Date - 4 NOV 03	Date Collected - 25 AUG 03	Sandy	
ID By - T. Stewart	Time Collected - 1720	QC by -	QC date -
SPECIES	COUNT	TOTAL #	NOTES
Chironomidae		17	
Oligochaeta A		2	
Odonata - Gomphidae?		1	
Hirudinea		2	
Corbicula fluminea		20	
Juvenile bivalvia		1	

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

[illegible]

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

[illegible]

**Matteo Iron and Metal
Benthic Macroinvertebrate
Inventory Data Sheet**

Station # - 2	Replicate # - 1	Substrate Type -	
ID Date - 4 NOV 03	Date Collected - 28 AUG 03	mud/clay	
ID By - T. Stewart	Time Collected - 0800	QC by -	QC date -
SPECIES	COUNT	TOTAL #	NOTES
Oligochaete A	 	112	
Chironomidae	 	49	
Isopoda (Anthurid)	1	1	
Corbicula fluminea		9	
Juvenile Bivalvia	1	1	

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

Station # - 2	Replicate # - 2	Substrate Type -	
ID Date - 4 NOV 03	Date Collected - 28 AUG 03	mud/clay	
ID By - T. Stewart	Time Collected - 0805	QC by -	QC date -
SPECIES	COUNT	TOTAL #	NOTES
Oligochaeta A		24	
Chironomidae		16 17	
Unknown Dipteran larvae	1	1	
Hirudinea	1	1	
Corbicula fluminea		11	
Juvenile Bivalvia			

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

Station # - 2	Replicate # - 3	Substrate Type -	
ID Date - 4 NOV 03	Date Collected - 28 AUG 03	mud/clay	
ID By - T. Stewart	Time Collected - 0810	QC by -	QC date -
SPECIES	COUNT	TOTAL #	NOTES
Corbicula fluminea	1	1	
Juvenile Bivalvia	1	1	
Hirudinea	2	2	
Oligochaeta A	23	23	
Chironomidae	4	4	
Nematode	1	1	

brian's sample

Station # - 3		Replicate # - 1	Substrate Type -	
ID Date - 5 NOV 03		Date Collected - 21 AUG 03	mud	
ID By - T. Stewart		Time Collected -	QC by -	QC date -
SPECIES	COUNT	TOTAL #	NOTES	
Oligochaeta A	 	149		
Nematoda		3		
Chironomidae	 	24		
Hirudinea		1		
Corbicula fluminea		9		

**Matteo Iron and Metal
Benthic Macroinvertebrate
Inventory Data Sheet**

Station # - 3	Replicate # - 2	Substrate Type -	
ID Date - 5 NOV03	Date Collected - 21 AUG 03	mud	
ID By - T. Stewart	Time Collected -	QC by -	QC date -
SPECIES	COUNT	TOTAL #	NOTES
Corbicula fluminea	II	2	
Oligochaeta A	III IIII	12	
Hirudinea	II	2	
Chironomidae	II	5	

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

[illegible]

**Matteo Iron and Metal
Benthic Macroinvertebrate
Inventory Data Sheet**

[illegible]

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

[illegible]

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

[illegible]

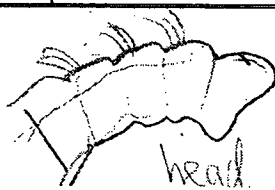
Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

Station # - 5	Replicate # - 1	Substrate Type -	
ID Date - 5 NOV 03	Date Collected - 21 AUG 03	Clay / mud	
ID By - T. Stewart	Time Collected -	QC by -	QC date -
SPECIES	COUNT	TOTAL #	NOTES
Oligochaeta A	 	28	
Chironomidae	 	22	
Hirudinea		1	
Oligochaete B	8	8	
Corbicula fluminea		9	
Juvenile Bivalvia			

Matteo Iron and Metal
Benthic Macroinvertebrate
Inventory Data Sheet

Station # - 5	Replicate # - 2	Substrate Type -	
ID Date - 6 NOV 03	Date Collected - 21 AUG 03	clay/mud	
ID By -	Time Collected -	QC by -	QC date -
SPECIES	COUNT	TOTAL #	NOTES
Oligochaeta A		6	
Chironomidae		17	
Oligochaeta B		5	
Corbicula fluminea		1	

Jeff



53

105 segments like peripoda
60+ up peripoda

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

Station # - 5	Replicate # - 3	Substrate Type -	
ID Date - 6 NOV 03	Date Collected - 21 AUG 03	clay/mud	
ID By - T. Stewart	Time Collected -	QC by -	QC date -
SPECIES	COUNT	TOTAL #	NOTES
Corbicula fluminea	1	1	
Oligochaeta A	 	32	
Chironomidae		7	
Oligochaeta B		6	

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

[illegible]

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

[illegible]

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

Station # - 6	Replicate # - 3	Substrate Type -	
ID Date - 6 NOV 03	Date Collected - 21 Aug 03	mud	
ID By - T. Stewart	Time Collected -	QC by -	QC date -
SPECIES	COUNT	TOTAL #	NOTES
Chironomidae	 	42	
Oligochaeta A	 	33	
Corbicula fluminea		2	lost one
Oligochaeta B		2	

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

[illegible]

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

Station # - 7	Replicate # - 2	Substrate Type	
ID Date - 6 NOV 03	Date Collected - 27 AUG 03	Silt-mud/clay	
ID By - T. Stewart	Time Collected - 0935	QC by -	QC date -
SPECIES	COUNT	TOTAL #	NOTES
Oligochaeta A		21	
Chironomidae		7	
Corbicula fluminea		1	
Oligochaeta B		3	

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

[illegible]

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

[illegible]

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

[illegible]

**Matteo Iron and Metal
Benthic Macroinvertebrate
Inventory Data Sheet**

[illegible]

**Matteo Iron and Metal
Benthic Macroinvertebrate
Inventory Data Sheet**

[illegible]

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

[illegible]

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

[illegible]

**Matteo Iron and Metal
Benthic Macroinvertebrate
Inventory Data Sheet**

[illegible]

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

[illegible]

Matteo Iron and Metal Benthic Macroinvertebrate Inventory Data Sheet

[illegible]

Appendix G

Statistical summary of benthic macroinvertebrates collected in the study area

Appendix H

NJDEP diagnostic consultation report - *Fundulus heteroclitus*

NEW JERSEY DIVISION OF FISH AND WILDLIFE
OFFICE OF FISH AND WILDLIFE
HEALTH AND FORENSICS
DIAGNOSTIC CONSULTATION REPORT

SITE	LOCATION	LATITUDE - LONGITUDE
Hessian Run	Matteo Site	
DIAGNOSIS	Trematode metacercariae by Edmund Washuta, Principal Biologist (Fish Pathology)	DATE 03-Sep-03

Fish from the Matteo site were examined at the request of Nancy Hamill, Ecological Risk Assessor in the Bureau of Environmental Evaluation and Risk Assessment, DEP. The site is under jurisdiction of the Site Remediation Program (SRP), Bureau of Case Management; Case Manager is Larry Quinn.

Fish were collected and submitted for examination under the direction of Rich Harding (973-678-1960 x 451). Collectors observed unusual swimming behavior, exophthalmos, and skin lesions on mummichogs and to a lesser extent on banded killifish (*Fundulus diaphanus*). Only mummichogs (*Fundulus heteroclitus*) were submitted for examination.

Site History (provided by Nancy Hamill):

Matteo Iron & Metal Site, 1708 US Highway 130, West Deptford, Gloucester County

The Matteo Iron & Metal Site is 80 acres in size, with the majority of the site unpaved and heavily wooded, with a slight slope toward the west/northwest direction of the Hessian Run and Woodbury Creek. These creeks are associated with extensive freshwater tidal marshes that are regularly flooded by daily tides. The site operated as an unregistered landfill, junkyard, and metal recycling facility between 1961 and 1968. A "sweating fire box" was used to melt lead battery terminals for lead reclamation until 1985. In 1972, NJDEP first observed landfilling of crushed battery casings in an area of wetlands adjacent to the Hessian Run and drums of hazardous waste throughout the property. Lead up to 20,000 mg/kg has been detected in sediments adjacent to the site; surface water concentrations of lead exceed the NJ surface Water Quality Standards. Currently, Matteo operates a recycling and junkyard operation.

As a frame of reference, SRP uses a sediment screening criterion for lead of 31 mg/kg; above this, there is potential for adverse ecological effects, and further investigation is needed. Sediment concentrations at Matteo ranged from around 100 - over 1000mg/kg.

Lesions observed on the fish examined from the Matteo site were the result of infection with unidentified trematode metacercaria. Other parasites found (*Phagicola diminuta* and *Eustrongylides* larvae) did not induce any gross pathology. Some of the lesions observed at necropsy may have been the result of handling during collection and transport. Bacteriologic examination revealed a systemic bacterial infection with *Aeromonas hydrophila* in one of nine fish examined and was not considered to be responsible for the external lesions observed. Neither exophthalmos nor erratic swimming behavior was seen in any of the fish examined.

NEW JERSEY DIVISION OF FISH AND WILDLIFE
OFFICE OF FISH AND WILDLIFE
HEALTH AND FORENSICS
DIAGNOSTIC CONSULTATION REPORT



DATE	Species	RefNo	SEX	AGE	LENGTH	WEIGHT	NECROPSY
04-Sep-03	Fundulus heteroclitus	001			2.5"	3.2 g	Gross - Red, inflamed area on operculum on right side, left normal in appearance. Wet micro - Trematode metacercariae in scrapings from opercular lesion; spined body, OS and VS unarmed; encysted trematode metacercaria abundant in gills, identified as Phagicola diminuta Bacteriology - TSA slant from kidney - no growth at 72 hrs
04-Sep-03	Fundulus heteroclitus	002			2.9"	5.2 g	Gross - Pink lesion in opercular region between operculum and preoperculum; pale area with some scale loss on left side of body. Wet micro - Trematode metacercariae in scrapings from operculum (as described above); moderately heavy infection of gills with Phagicola diminuta metacercariae; single Eustrongylides in body cavity Bacteriology - TSA slant from kidney - no growth at 72 hrs
04-Sep-03	Fundulus heteroclitus	003			3.3"	6.1 g	Gross - Pink raised area on operculum Wet micro - trematode metacercariae associated with opercular lesion; moderately heavy infection of gills with Phagicola diminuta metacercariae. Bacteriology - TSA slant from kidney - no growth at 72 hrs
04-Sep-03	Fundulus heteroclitus	004			3.1"	7.8 g	Gross - Pale, rough areas of scale loss on back; red lesion on operculum Wet micro - No significant amount of bacteria or fungi present in smears from pale areas on skin; trematode metacercaria present in red opercular lesion (oval, spined cuticle, aspinous OS); liver pale; heavy infection of gills with Phagicola diminuta metacercariae. Bacteriology - TSA slant from kidney - growth in 24 hrs at 25C - oxidase positive, gram negative, TSI A/A, identified as Aeromonas hydrophila
04-Sep-03	Fundulus heteroclitus	005			2.5"	4.3 g	Gross - pale lesions on skin Wet micro - no parasitic, bacterial or fungal involvement in skin lesions; Phagicola diminuta cysts present in gill filaments; single Eustrongylides coiled in body cavity Bacteriology - TSA slant from kidney - no growth at 72 hrs
04-Sep-03	Fundulus heteroclitus	006			2.7"	3.7 g	Gross - pale lesions on skin Wet micro - no parasitic, bacterial or fungal involvement in skin lesions; numerous Phagicola diminuta cysts present in gill filaments; single Eustrongylides coiled in body cavity Bacteriology - TSA slant from kidney - no growth at 72 hrs
04-Sep-03	Fundulus heteroclitus	007			2.7"	4.8 g	Gross - pink area on operculum / preoperculum Wet micro - trematode metacercaria in scrapings from opercular lesion; Phagicola diminuta metacercaria in gills; single Eustrongylides in body cavity Bacteriology - TSA slant from kidney - no growth at 72 hrs
04-Sep-03	Fundulus heteroclitus	008			2.3"	2.1 g	Gross - pink area on opercle Wet micro - trematode metacercariae in scrapings from opercular lesion; Phagicola diminuta in gills Bacteriology - TSA slant from kidney - no growth at 72 hrs

ACC. NO.

31-IA

NEW JERSEY DIVISION OF FISH AND WILDLIFE
OFFICE OF FISH AND WILDLIFE
HEALTH AND FORENSICS
DIAGNOSTIC CONSULTATION REPORT



DATE	Species	RefNo	SEX	AGE	LENGTH	WEIGHT	NECROPSY
04-Sep-03	Fundulus heteroclitus	009			2.6"	3.6 g	Gross - pink area between operculum and preoperculum Wet micro - trematode metacercariae in scrapings from opercular lesion; Phagicola diminuta in gill cysts Bacteriology - TSA slant from kidney - no growth at 72 hrs

Hessian Run 2/17/2004

Fundulus heteroclitus 9:15:59 AM

heteroclitus) collected on 3 September 2003 from Hessian Run, a tributary to Woodbury Creek, were delivered to the Hackettstown SFH lab by Rich Harding.

Collectors had observed unusual swimming behavior, exophthalmos, and skin lesions on mummichogs and to a lesser extent on banded killifish (*Fundulus diaphanus*).

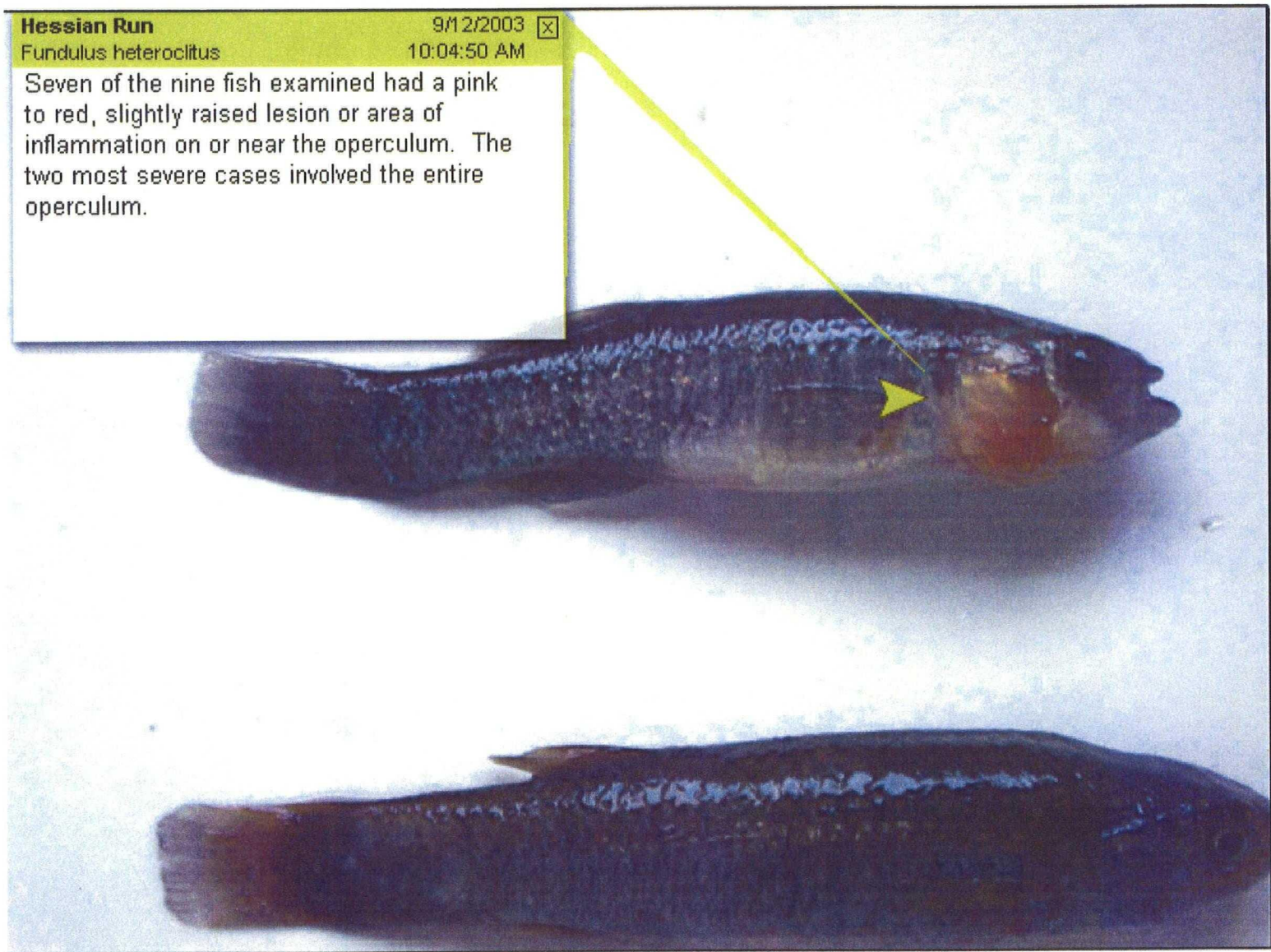
Necropsy of nine live specimens was performed at the Pequest SFH laboratory on 4 September 2003.

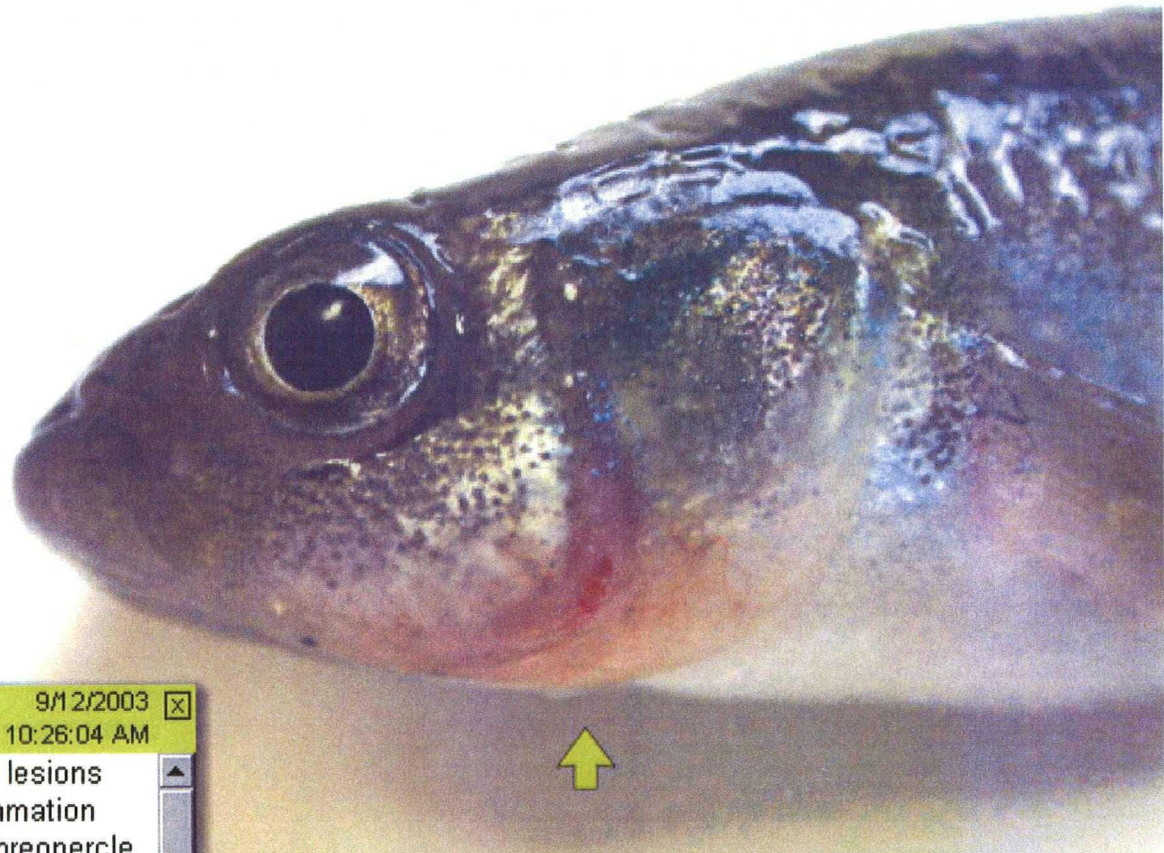


Hessian Run*Fundulus heteroclitus*9/12/2003 ☐

10:04:50 AM

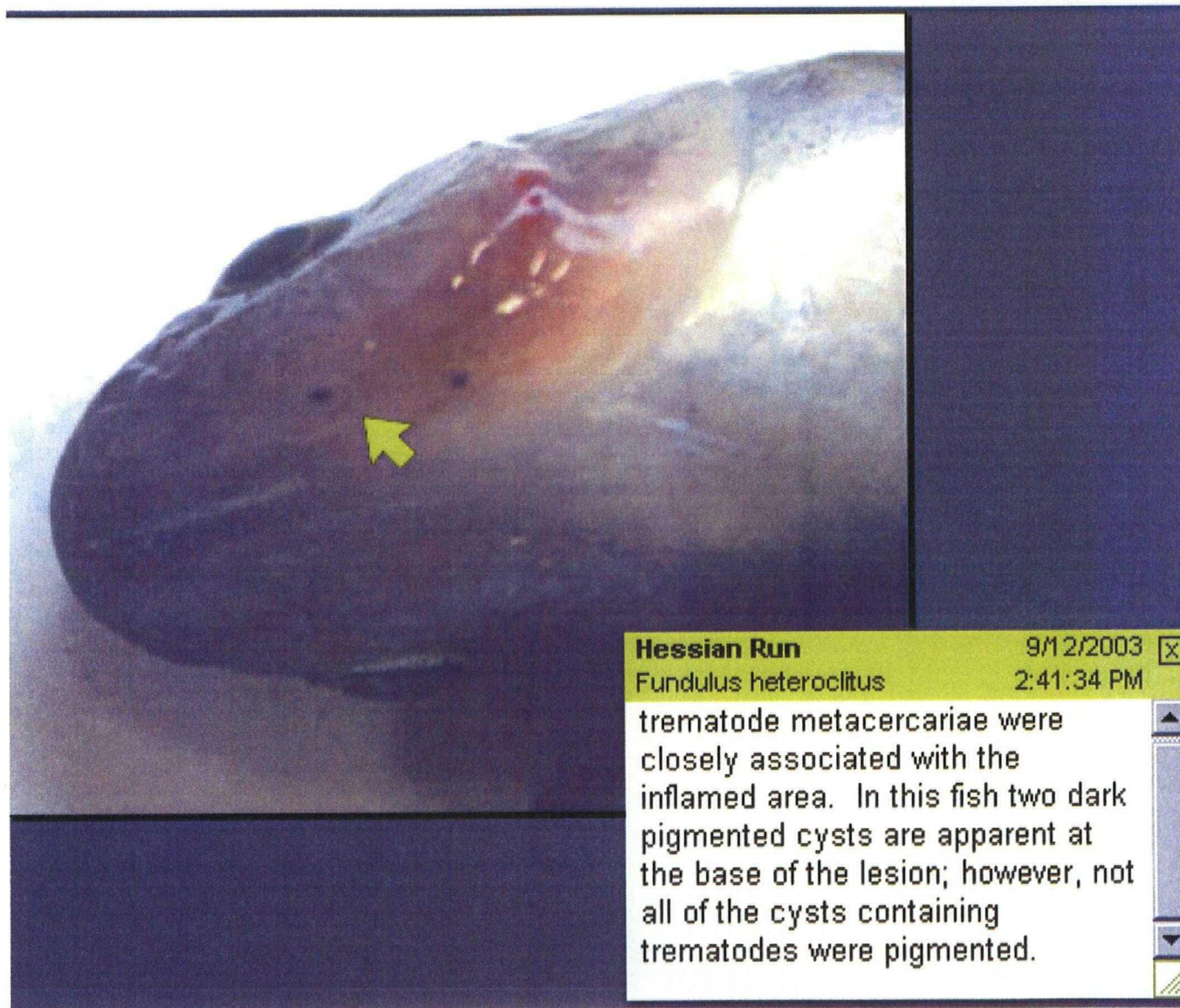
Seven of the nine fish examined had a pink to red, slightly raised lesion or area of inflammation on or near the operculum. The two most severe cases involved the entire operculum.





Hessian Run 9/12/2003 [X]
Fundulus heteroclitus 10:26:04 AM

More commonly, external lesions were a focal area of inflammation between the opercle and preopercle of the fish.



Hessian Run

9/12/2003



Fundulus heteroclitus

2:41:34 PM

trematode metacercariae were closely associated with the inflamed area. In this fish two dark pigmented cysts are apparent at the base of the lesion; however, not all of the cysts containing trematodes were pigmented.

Fundulus heteroclitus 9/12/2003 [X]
trematode metacercaria 12:26:07 PM

Photomicrograph of a trematode metacercaria from a cyst on the operculum of *Fundulus heteroclitus*. These trematodes were always associated with pink-red, skin lesions on *Fundulus diaphanus* and were not found on other areas of the skin.



Fundulus heteroclitus 9/12/2003
trematode metacercaria 12:33:43 PM

metacercaria from a cyst on the operculum of *Fundulus heteroclitus*. The cuticle of the trematode was covered with minute spines; however the oral sucker was unspined.

Morphologically, this trematode was not consistent with any of the species previously reported in *Fundulus heteroclitus* or *Fundulus diaphanus*.

Presumably, these species of *Fundulus* are not the normal second intermediate hosts of this trematode. That might account for the unusual host reaction (skin lesions) to the infection.





Hessian Run

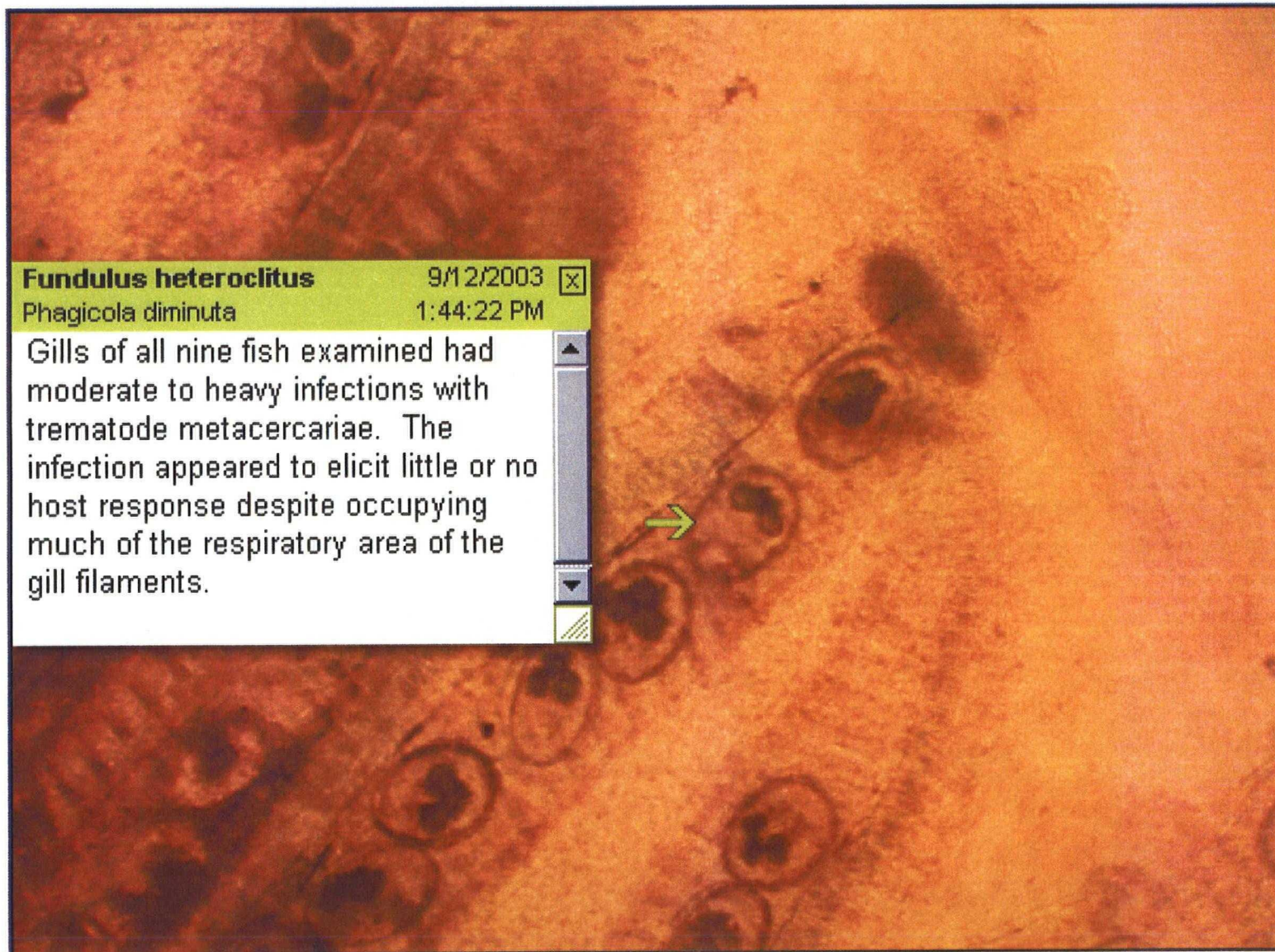
Fundulus heteroclitus

9/12/2003

2:11:12 PM

Three of nine fish examined had pale skin lesions where scale loss was apparent. Microscopic examination of those areas of skin did not reveal any parasites or significant bacterial or fungal involvement. They were most likely mechanical injuries that resulted from collection and handling.

Bacteriologic examination of the nine fish revealed a systemic infection in only one fish. The bacteria involved, *Aeromonas hydrophila*, is a common freshwater inhabitant that can infect and cause disease in fish under conditions of stress. Stress associated with collection, handling, and transport may have induced the infection in this case.



Fundulus heteroclitus

9/12/2003

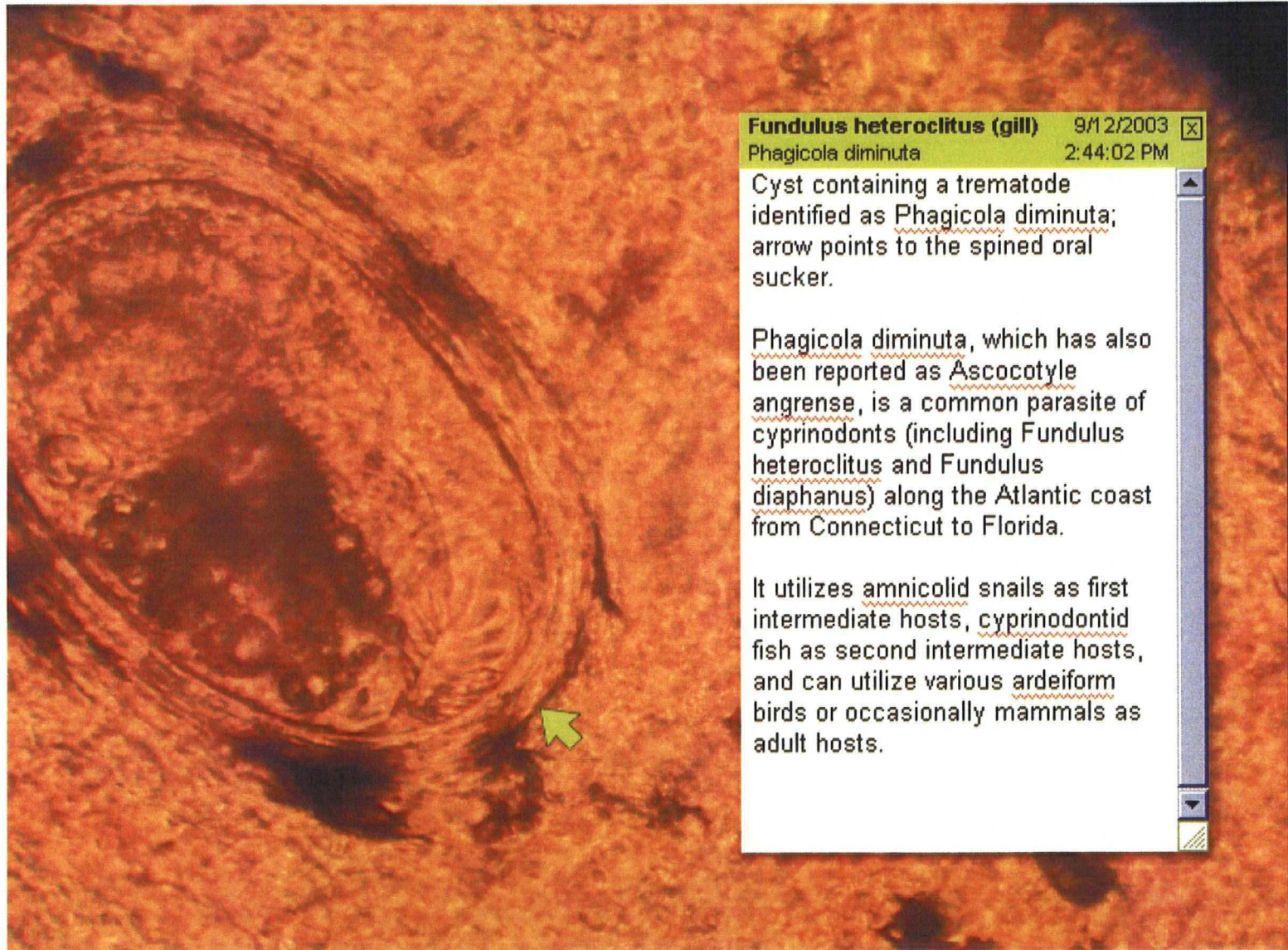


Phagicola diminuta

1:44:22 PM

Gills of all nine fish examined had moderate to heavy infections with trematode metacercariae. The infection appeared to elicit little or no host response despite occupying much of the respiratory area of the gill filaments.





Fundulus heteroclitus (gill) 9/12/2003 [X]

Phagicola diminuta 2:44:02 PM

Cyst containing a trematode identified as Phagicola diminuta; arrow points to the spined oral sucker.

Phagicola diminuta, which has also been reported as Ascocotyle angrense, is a common parasite of cyprinodonts (including Fundulus heteroclitus and Fundulus diaphanus) along the Atlantic coast from Connecticut to Florida.

It utilizes amnicolid snails as first intermediate hosts, cyprinodontid fish as second intermediate hosts, and can utilize various ardeiform birds or occasionally mammals as adult hosts.

Fundulus heteroclitus

Eustrongylides

9/12/2003

2:07:08 PM

Larval nematodes, identified as *Eustrongylides* sp. were found coiled in the body cavities of four of the nine fish examined. Infections, in all cases consisted of a single worm.

Eustrongylides is a common parasite of *Fundulus heteroclitus* in New Jersey. First stage larvae are found in oligochaetes; adults develop in fish-eating birds, most commonly the great blue heron. Fish serve as "transport hosts" for the parasite.

